VOL. 23

MAY, 1938

NO. 5

The Welding Engineer

MEMBER

Associated Business Papers
Audit Bureau of Circulations
American Welding Society
International Acetylene Association

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Published on the 15th of each month by The Welding Engineer Publishing Company, 608 S. Dearborn Street, Chicago, Ill. Telephone Webster 7134

Advertising copy must be received not later than the 5th of each month.

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Welded freight car underframe fabricated of low-alloy high-tensile steel. Pullman-Standard Car Mfg. Co. has just completed 200 welded light-weight box cars using this frame, in its plant at Michigan City, Ind. (Descriptive article will be published next month.)

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Subscription, payable in advance: United States and possessions, and Canada, $3 a year; Foreign Countries, $4 a year; Single copy, domestic, 25 cents; Single copy, foreign, 35 cents. Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

FOREIGN REPRESENTATIVES: AUSTRALIA and NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand; GREAT BRITAIN—A. D. Baynes, 6, Mordaunt House, Larkhall, Clapham, London, S. W. 8, England; SOUTH AFRICA—J. W. Arnison, 35a Victoria Avenue, Benoni, Transvaal, South Africa; JAPAN—Maruzen Company, Ltd., 6, Nihonbashi, Tori-Nichome, Tokyo, Japan; U. S. S. R.—Mesdunarodnaja Kniga, Kusneski Most 18, Moscow, U. S. S. R.

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Structural Welding Progress

IN THE PAGES of this issue we publish a review of some of the important welded buildings erected during the past year. The reader will note that most of these are industrial structures which were erected by the Austin Co., a pioneer in this form of construction. It will also be noted that manufacturers of welding machines and welding electrodes have been the quickest to adopt this new idea in industrial building. Evidently they believe what they say about welding.

In this article on structural welding the reader will note an account of the first welded steel structure to be erected in New York City since passage of the new building code which went into effect January 1, 1938. In this connection a great deal of credit is due Gilbert D. Fish, prominent structural engineer and chairman of the American Welding Society's Committee on Building Codes. Mr. Fish was instrumental in getting the new building code enacted in New York City and through his initiative was influential in revising the plans of this structure, known as Kensington House, at 20th St. and 7th Ave., to make it the first welded building in Manhattan. In common with other welded structures, the majority of the welding was done in the shop under rather ideal conditions. Checking Mr. Fish's figures, we find that out of a total of 11,869 ft. of welding, 69 per cent was handled in the shop. As designers become more familiar with this new technique of construction, it is possible that shop welding will comprise a larger percentage of the total.

American Welding Society should be given a great deal of credit for this "breaking of the ice" in New York City under the new code. If labor restrictions do not place too big a burden on the building owner, it is logical to anticipate that the building now being erected will be the first of a number of welded buildings not only in New York but other large cities. As a basis for this confidence, we point to the progress which has been made in welded buildings in European countries, notably England, Germany and France.

★

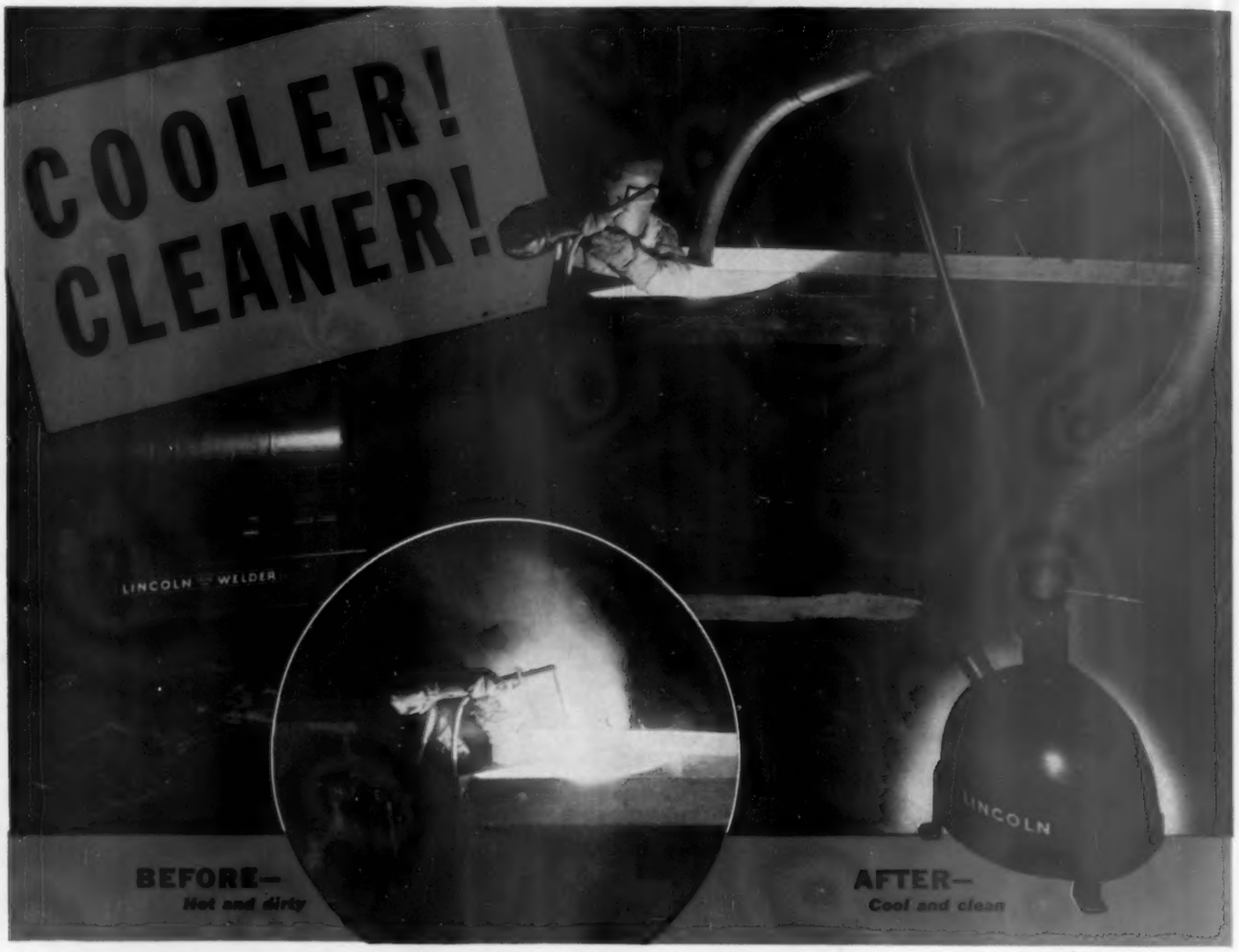
Light-Weight Welded Box Cars

THE COMBINATION of low-alloy structural steels and welded fabrication is a very effective one in reducing the weight of railroad equipment. Railroad mechanical executives are more weight conscious than ever before. Their desire to reduce equipment weight first became evident in the passenger field, but lately there has been interest displayed in the reduction of freight car weight.

A contract for 2600 freight car underframes for the Union Pacific Railroad has just recently been completed by the Ryan Car Co. As the reader will note in the article on page 19, the railroad's inquiry was based on riveted construction, but the equipment builder, on his own initiative, prepared a second estimate based on a redesign for welded fabrication with a substantial saving in weight. The railroad was convinced and the order was executed on the basis of the welded design.

Another equipment builder, Pullman-Standard Car Mfg. Co., has just recently completed fabrication of 200 light-weight low-alloy welded box cars. These are the first cars of this type to be manufactured on a production basis, using the latest type of arc welding and spot welding equipment. Our front cover this month illustrates top and bottom views of a completely welded underframe for this new light-weight car. A saving of 9,000 lbs. in dead weight is accomplished as compared with the latest A. A. R. design of steel car, using conventional riveted fabrication. This permits an increase in maximum lading from 124,500 lbs. to 133,400 lbs., a gain of 7.1%.

A statistical study of railway operating costs has been made by the research department of a large steel producer. This organization has estimated that on the average it costs the railways of the United States $18 per ton, per car, per year, to haul freight trains. It costs just as much to haul dead weight as to haul pay load. Thus, with an opportunity to save 4½ tons per car in dead weight, the railroads now have an opportunity to save about $80 per car, per year, in operating costs. The railroads need modern equipment in order to reduce their costs per ton-mile. Business, and particularly the steel business, needs more railway equipment buying. Normally, the railroads are the steel industry's second best customer, consuming about 25 per cent of the industry's output. It seems inevitable that the railroads in the next few years will come into the market for thousands of light-weight freight cars and this will create considerable demand for welding operators, welding equipment, and supplies. Mass production methods will bring down costs of welded fabrication to figures lower than any which have yet been realized.



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Welders working on the underframe, parts accurately positioned in an assembly jig.

Arc welding, on production basis, of

Freight Car Underframes

★ Clamping fixtures and positioning jigs expedite arc welding — Stack cutting with oxy-acetylene flame cuts costs and saves time

AMERICAN RAILROADS with lowered earnings due to competition and the business recession are faced with the necessity of lowering operating costs. Welded fabrication of rolling stock using low-alloy high-strength materials makes such savings possible of accomplishment.

An order for 2,600 freight car underframes has just been completed in the Hegewisch (Ill.) Plant of The Ryan Car Co. for delivery to the Union Pacific Railroad. The original inquiry was for riveted construction. In submitting the bid for this inquiry, C. B. Faverty, chief engineer of the Ryan plant, also included a bid covering a complete redesign using welded construction. It indicated a weight reduction as well as more economical fabrication cost. With factual data gathered from other welded construction it was possible to show and guarantee that the welded design would serve as well, if not better, than the riveted fabrication from the point of view of first cost, safety in operation, and lower operating cost.

With the order placed it was necessary to gear the plant to carry it through to completion in satisfactory manner. The job was put on a line production basis throughout. Each part of the whole unit was shaped and finished at one point in the plant to converge at last for assembly into the whole.

The center sill was made up of 2 mild steel standard A. A. R. Z-Sections 41 ft.-6 in. long, each coped and measured to exact dimensions from one end. Where the bolster center filler was riveted in place (the only riveting on the assembly) rivet holes were punched and reamed before welding. A special assembly jig for this unit positioned each Z-section which was spaced about 1/16-in. apart with spacers on the longitudinal seam. It was clamped down every three feet with 1¼-in. camber in the center and tacked. A continuous one-pass weld was run with a 5/16-in. heavily coated electrode at 550 amp., producing a weld of about 50% penetration. This provided sufficient strength for the type of design used, since the weld is not in shear at any time in operation. On the reverse side a 36-in. bead was run at each body bolster position.

The next step was welding or riveting the bolster center filler, whichever construction was specified. A drop forged body center plate was next added by welding to the sill at each bolster position. With the sill on its

Completed Union Pacific underframe fabricated by arc welding.

side S. A. E. 1020 drop forged front draft lugs were positioned and tacked in place in coped openings provided. Positioning involved accurate gauging from the back stop. An interesting welding procedure was used here to eliminate the possibility of distortion. The weld was started about ⅞ of the distance from the open end, continued around the end of the forging and then to the end of the center sill. After allowing the part to cool a bit, the weld was completed from the starting point to the open end opposite to that first finished. Contraction of the cooling metal pulled the forging and Z-section to exact alignment. With the welds on one side completed the sill was turned over and the weld on the opposite side completed. This made down-hand welding possible at all points where the forging and sill joined.

Body Bolsters

In another part of the plant, the body bolsters (box-section assemblies of 5/16-in. Corten plate) were fabricated. The two component parts were cut to shape with an oxy-acetylene shape cutting machine. An important time-saving factor was the stack cutting of these parts with fifteen plates clamped tightly together on the cutting table and all cut in one operation of the flame cutting head. The cut plates were then moved to heating furnaces and forming presses where they were hot pressed to required shape. Hot pressing was used to eliminate the possibility of setting up

Underframe mounted in welding trunnion to permit downhand welding of certain joints.

The two parts of the body bolster (5/16-in. Corten plate) were flame cut and then welded into a box-section.

strains due to cold working. Corrugations were pressed into the underside section, a compression member, which added 25 to 30% to the strength of the plate acting as a column. A third part of this unit was a channel section for inside reinforcement.

The inside reinforcement was positioned, tacked and welded into the underside section. The upper and underside sections were then tacked together by set-up gangs. Welding crews assigned to this job then completed the welds on each side. Since the fit-up of the joints could not be made accurately, an important consideration was the choice of an electrode to produce a weld to fill up the irregular fit.

Still a third operation was the fabrication of the cross bearers which were of ¼-in. Corten. The top and bottom sections were shaped and reinforcing plates sheared to the required size. The component parts were assembled in jigs, tacked and finish welded. Jigs were of a type which could be revolved permitting all welding in a downhand position. Other forming operations included making end sills of ¼-in. angles; diagonal braces hot pressed from 3/16-in. plate; cross ties of 4-in. rolled and shaped channels and the ⅛-in. pressed channels for the floor stringers.

Production of each of these units was carried on so that a steady flow in sufficient quantity reached the underframe assembly track, without causing confusion with too fast delivery or holding up work by delays in delivery of sub-assemblies. At this point two jigs were constructed which were unique in their conception and which played an important part in carrying out the job successfully. A fitting crew placed all component parts in the jig. For speedy operation, fast-acting air hoists on moving cranes were provided for material handling. First the center sill, body bolsters, cross-bearers, cross-ties and side sill reinforcements were positioned upside down in the jig, which was constructed in such fashion that each part was automatically positioned. Drive clamps held them firmly in place until tacking and welding was completed. Jigging made it possible to do all welding down-hand.

Production Teamwork

With welding on the bottom completed, clamps were released and the partially welded unit turned over right side up at an adjoining station. Here alignment and dimension were checked with gauges. Then end sill, diagonal braces and striker were put in place. Welding again was all down-hand. One of the operations at this station was the addition of splice plates. Four were used at the body bolster joints and two on the cross-bearers. They were added solely as an additional factor of safety, even though the design in itself is of sufficient strength for all load requirements in operation.

With the welding crew finishing the welding on a loaded jig, the fitting crew loaded an identical jig on the opposite side of the aisle. The work was gauged so closely that by the time welding in one position was finished, the fitting crew had loaded the idle jig, and was available to turn the completed underframe for finish welding on the top side. The average time for finish welding an underframe after clamping in position was about 40 min.

From this point the frame proceeded on a dolly to the stringer position where all miscellaneous parts, such as brackets and other attachments were tack welded in place. Some were com-

Welded body bolster.

End view of welded center sill.

Welded cross bearer fabricated in an assembly jig.

pletely welded (where down-hand welds were possible) and the balance were left tacked for finish welding at the trunnion position to which the frame next advanced. The trunnions made it possible to rotate the frame so that joints, which in operating position are located vertically, could be made with a down-hand weld.

With all welding completed, company and railroad inspectors went over the unit, checking it for exact length, width and location of brackets. Visual inspection of welds was made and where there was any question of penetration or soundness of deposit, the doubtful area was chipped out and rewelded. When passed, all welds were carefully cleaned of slag deposit and wire brushed, after which the frame was spray painted and passed along to the loading platform.

Operator Testing

The size of the job, once it was authorized, required hiring welders in addition to those on the regular staff in the Ryan plant. A newspaper classified advertisement brought in the neighborhood of 1,000 applicants of which about 600 had welding school training, but insufficient practical experience to give them consideration for this job. About 300 were tested, 150 of whom worked for a short time but the welding crew was finally reduced to about 90 men working in two shifts.

In testing all applicants, sample welds were made with the same materials and electrodes which were to be used on the job. The weld was broken in a vise and examined for character of weld metal and penetration of the deposit. This was all that was deemed necessary under the circumstances for the base materials were of known welding quality. Murex and Sureweld electrodes were mostly used on the job, along with some of other manufacture and all rods were of the heavily coated type, assuring good character of deposited metal. Electrodes were specified according to the joint requirements, such as good finish, concave fillets, strength, or poor fit up.

While the welding application was carried on successfully and economically, producing strong light underframes much credit must be given to the careful jigging and thoughtful organization of the crews handling the work. Jigs turned out finished work without spoilage or rewelding due to misalignment. Fit-up crews had work always ready for the welding crew. The welding crews were divided so that the same men continued to work on the same part day after day and acquired skill and speed in their work.

As the job was carried to completion many advantages of welded fabrication became apparent. It is seen that much shop space is saved as compared with that needed for riveted construction. It is also a much quieter shop on this account. The construction crew is also much more flexible, which is made possible by the fact that qualified welders can be placed on duty as helpers or assemblers and are immediately available to fill in, if layoffs or sickness disrupt the welding crew.

Since this job was started some cars for which the underframes were made in the Ryan plant have been completed. In a test, a fully loaded car was brought up to a speed of 15 m. p. h. and bumped into a string of standing box cars. Examination of the welded underframe failed to show evidence of weld failure. The weight of the welded underframe is 1,425 lbs. lighter than a comparable unit of riveted construction. This is an important consideration for railroad men who are continually striving for lower operating costs and greater pay loads.

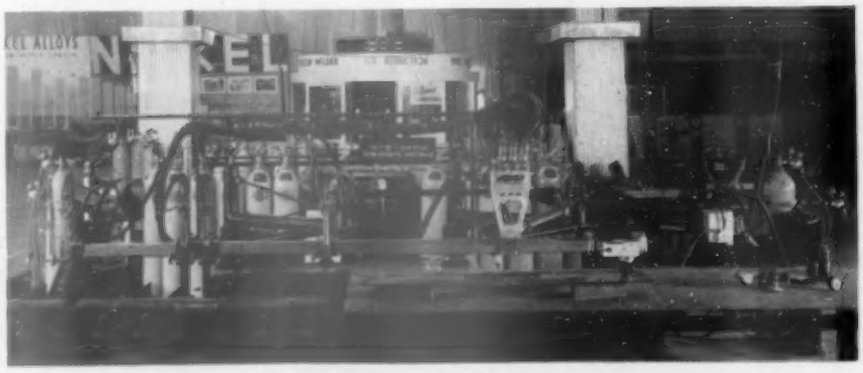
Airco Exhibit at Metal Show Featured Flame Cutting

★ The Air Reduction Co. had a comprehensive display of their products in booth G-27 at the Western Metals Congress and Exposition held in the Pan-Pacific Auditorium at Los Angeles, Calif., during the last week of March.

In addition to a display of hand cutting and welding apparatus and supplies, Air Reduction featured a working exhibit of its mechanical gas cutting machines handling actual production jobs. The machines which were featured were the new No. 10 Radiagraph, the No. 1 Travograph, No. 1 Tractograph, No. 1 Omnigraph and a round bar stock cutting machine.

Other applications for welding and cutting tools were demonstrated; such as the flame hardening of metals utilizing the No. 4 Radiagraph, the beveling and welding of pipe, the application of hard-facing alloys to worn surfaces to lengthen the service life of parts so treated, the low temperature brazing of non-ferrous metals, etc.

Tests, beyond actual field conditions, were conducted to illustrate a few of the claims made for the superiority of Airco-DB pressure regulators. Also on display was the new Wilson 300 amp. "Yellow Jacket" welder as well as a number of National Carbide V-G lights and lanterns.



Machine flame cutting demonstrations were a feature of the Airco exhibit at the Western Metals Exposition.

FIG. 1—Shop welders working on a roof truss.

FIG. 2—Part of continuous steel framing for drill hall of State Armory. Schenectady, N. Y.

FIG. 3—Completed addition at East Pittsburgh plant of Westinghouse.

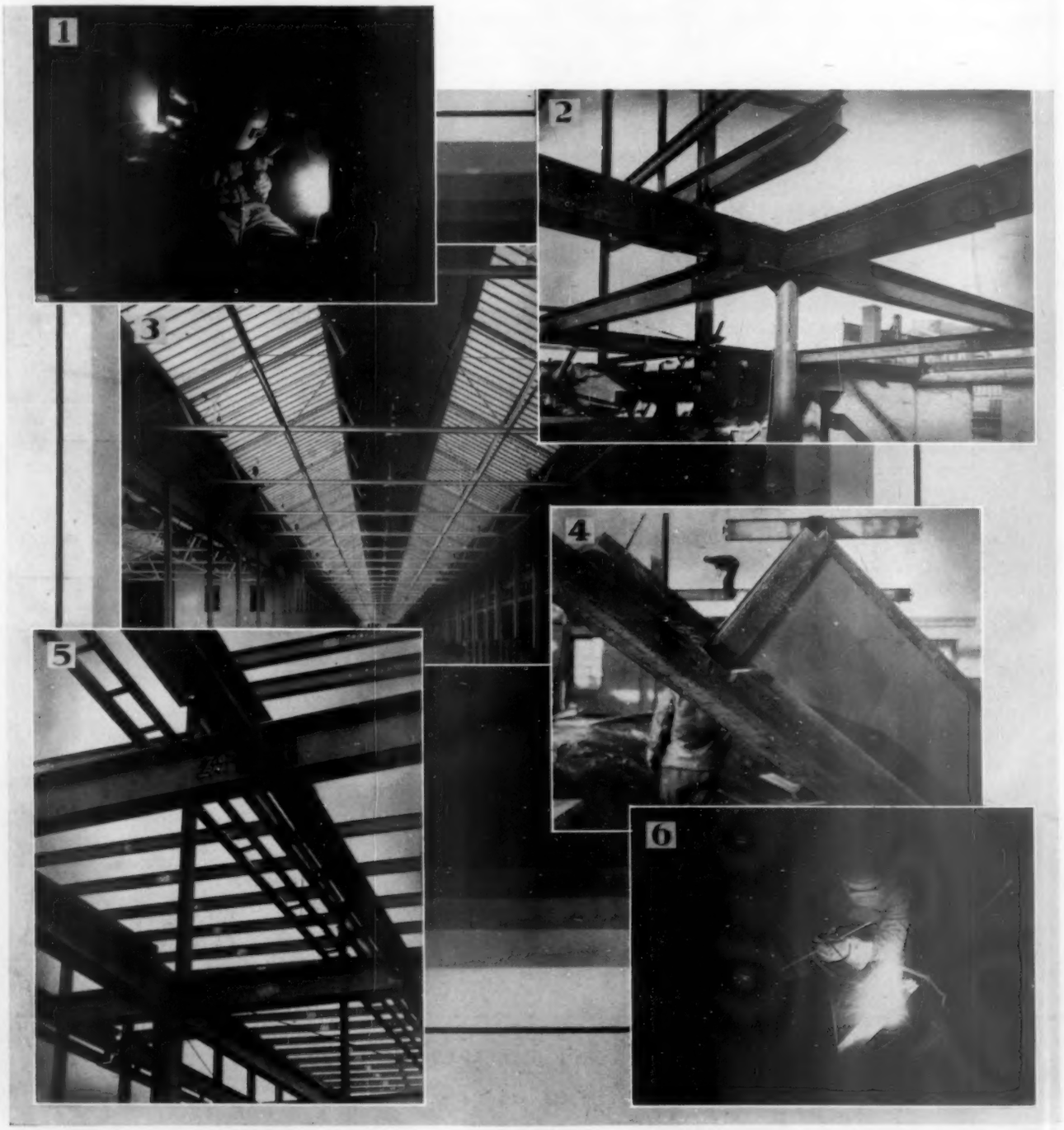
FIG. 4—Details of splice plates in top flange and in web of 150-ft. span two-hinged roof arch.

FIG. 5—Roof framework of new WGY Studio building.

FIG. 6—Close-up of welder making shop weld on roof truss shown erected in Fig. 3.

Structural Engineering

★ Designers and industrial executives are pointing the way to a more modern construction technique — Shadowless daylight provides better working conditions



ee winging to Welding

THERE IS EVIDENT a rather widespread interest in welded buildings, despite the obvious fact that construction activity is at a low ebb. Industrial buildings are pioneering in this relatively new application of welding, but many new public buildings and commercial buildings of all types will probably be designed for arc welded

FIG. 7—Welded floor beams at second story level of new Lincoln Electric plant.

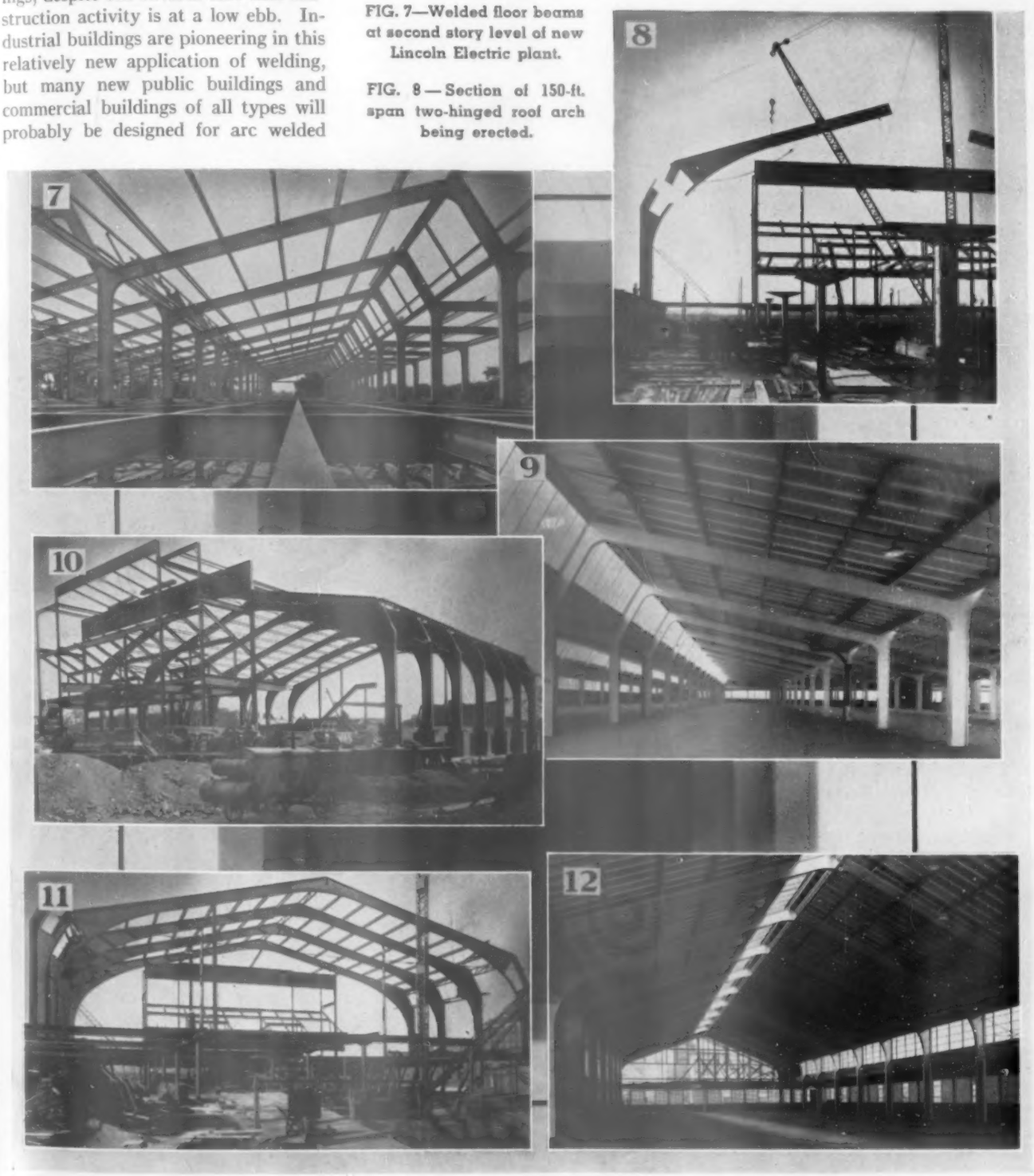
FIG. 8 — Section of 150-ft. span two-hinged roof arch being erected.

FIG. 9 — Rigid truss-less sawtooth construction provides ideally lighted working area.

FIG. 10—Seven main arches and giant welded plate girder of State Armory, Schenectady, N. Y.

FIG. 11—Four welded arches and part of framing for floor.

FIG. 12—Lofty bay (240 ft. wide) with 80-ft. clear span floor to roof.



fabrication. Building codes have been revised in many cities to permit use of this newer silent method of steel erection. New York City and Chicago have cleared the way for welded buildings, but it is too early yet to determine how much interest will be shown by architects and structural engineers in these key cities. Welded buildings have made relatively more progress in European countries than in the United States. It is reasonable to expect more encouraging progress in this country, now that a few bold, pioneering industrialists have broken the ice of design tradition and set an example which other business men, probably more timid and skeptical, may follow.

In the pages of this article we review current building projects wherein welding has played an important part. Every new building or plant addition fabricated with the "electric needle" establishes additional convincing evidence that welded buildings are safe, economical, and artistically pleasing to the eye.

Westinghouse Arc Welds Trusses of New Building

★ It was necessary to provide additional floor space for the mass production of industrial a-c. motors at the East Pittsburg plant of Westinghouse. There was an open space 58 ft. wide between two existing buildings that was used for storage of castings. By enclosing this space and removing the brick walls of the adjacent buildings, an additional 79,000 sq. ft. of floor space was obtained. We are indebted to J. B. George, works architect of this company, for an account of the welded design features and erection procedure used on this recently completed plant addition.

A compound fink type of truss was designed with a 10-ft. skylight along the center of each side of the roof for the entire length of the manufacturing space. The space on either side of the skylight was covered with a steel deck, ½ in. of insulation and waterproofing. The structure for covering the open space required 45 trusses on 20 ft. centers with the necessary purlins and seat angles. Where the space was too great to span with one truss, columns were erected and the space was spanned with two trusses.

The trusses, columns and all detail structural parts were designed for welded construction which permits lighter tension members, exclusion of gusset plates, and simplifies the tool equipment necessary to do this work. The trusses were made up of shapes best suited for welded construction. The top and bottom chords are H beams and the intermediate members are made of T bars and H beams, the tension members are flat bars. The shapes were chosen which were the most economical to sustain the required stress and to construct.

After the designs were completed, the shapes for the trusses, purlins and columns were ordered from the mill cut to the required length. Where it was necessary to cope, or to cut a member on an angle, a cutting torch was used. The only holes required were for use during erection.

Welded Seat Angles

For the erection of the trusses, seat angles were welded to the columns of the existing buildings, this method of construction eliminates the laying out and drilling of holes as in riveted construction. After the trusses were in place, purlins were temporarily bolted at each end and the middle of the truss in order to keep the trusses plumb. The intermediate purlins were then erected in place and welded to the truss without the aid of erection bolts. The columns and base plates were received from the mill cut to length and size, and the base plates were welded directly to the base of the column without the end of the columns being milled.

Assembly of the trusses was done as near to their erection site as possible. As there was overhead crane service in one of the original buildings, four arc-welding machines were connected up in this building and the first truss assembled on the floor from a layout. This truss was fastened to the floor and flat bars and angles were welded to it in such a manner that an assembly fixture for the following trusses was easily made. Two of these fixtures were made to allow the fitters to assemble ahead of the welders and reduce the lost time of the workmen.

Welding Speed

Each truss weighs 2,200 lbs. and required 295 in. of 5/16-in. fillet weld. The operators averaged better than five feet per hour welding speed using 3/16-in. covered electrodes. This measure of speed includes all of the time lost in starting and stopping. In the matter of calculating estimated cost data for any welded structure, it is vitally necessary to take into consideration not only the position of the members to be welded, but also the size of each weld and the time required to move from one position to another.

In the case of built-up sections requiring, either continuous weld or equally spaced sections of weld, this speed might be easily doubled. An operator is shown placing a weld at the connection between the top and bottom chord. Another illustration shows operators taking advantage of the greater welding speed from the down-hand position. This not only increases welding speed, but improves its physical characteristics and appearance.

The erection crew normally consisted of two welders, two groundmen and a connector along with an operator for the steam derrick. In the erection of a bay, the welders, one on each truss with an additional man to help, landed the purlins and made the welds while the ground crew were making the hitch for the next piece.

Field Welding

Field welding consisted of 50 in. of ¼-in. fillet weld connecting the purlins to the trusses and 12 in. of ⅜-in. weld fastening the truss and clip angle to one column. The other end of the truss rested on a lintel set in the brick work of the other building owing to the fact that these old building columns had not been set the same distance apart. With this set-up there is no following up of the erection, other than the inspector who checks the field welds and also the shop welds.

The steel deck crew of three men erected the deck at a rate of 300 sq. ft. per day, per operator, making three ½-in. tacks at top and bottom of each 24-in. wide sheet. An illustration shows the welder making one of the welds at the top of the sheet. This is done by using a current of 175 amp. and burning through the decking material and then fastening the edges of this hole to the purlin. It has been found that this method of application of steel decking materially improves the stability of the roof and also strengthens the structure against horizontal stresses.

The supporting members for the skylights were made from 2-in. by 2-in. T bars with special clip attachments. These bars were erected with a crew of four men. Two welders and an erector making up the top crew and a helper to aid in raising. This crew was able to erect and weld in place 800 sq.

ft. per man, per eight-hour day. In completing the building, arc welding was used to advantage in the mounting of brackets for the sprinkler piping, the lighting brackets, power feeder supports and in connections on the 150-lb. process steam line.

The total floor space provided by this project is 197,000 sq. ft., of which 55,000 is new. The total steel used, not including the roof decking and skylight bars was 520,000 lbs., or an average of 10.4 lbs. per sq. ft. Total quantity of welding rod was 2,250 lbs.

There are many advantages to be gained by the use of welding, but in order to realize them fully the designer as well as the contractor must judiciously select sections. In this way a building may be completed which uses the full weight of the members to the greatest possible advantage.

Schenectady, N. Y. Is Welding Minded

★ Several arc-welded buildings completed recently in Schenectady, N. Y., give this busy industrial city some claim to distinction in the construction world. Schenectady can justifiably

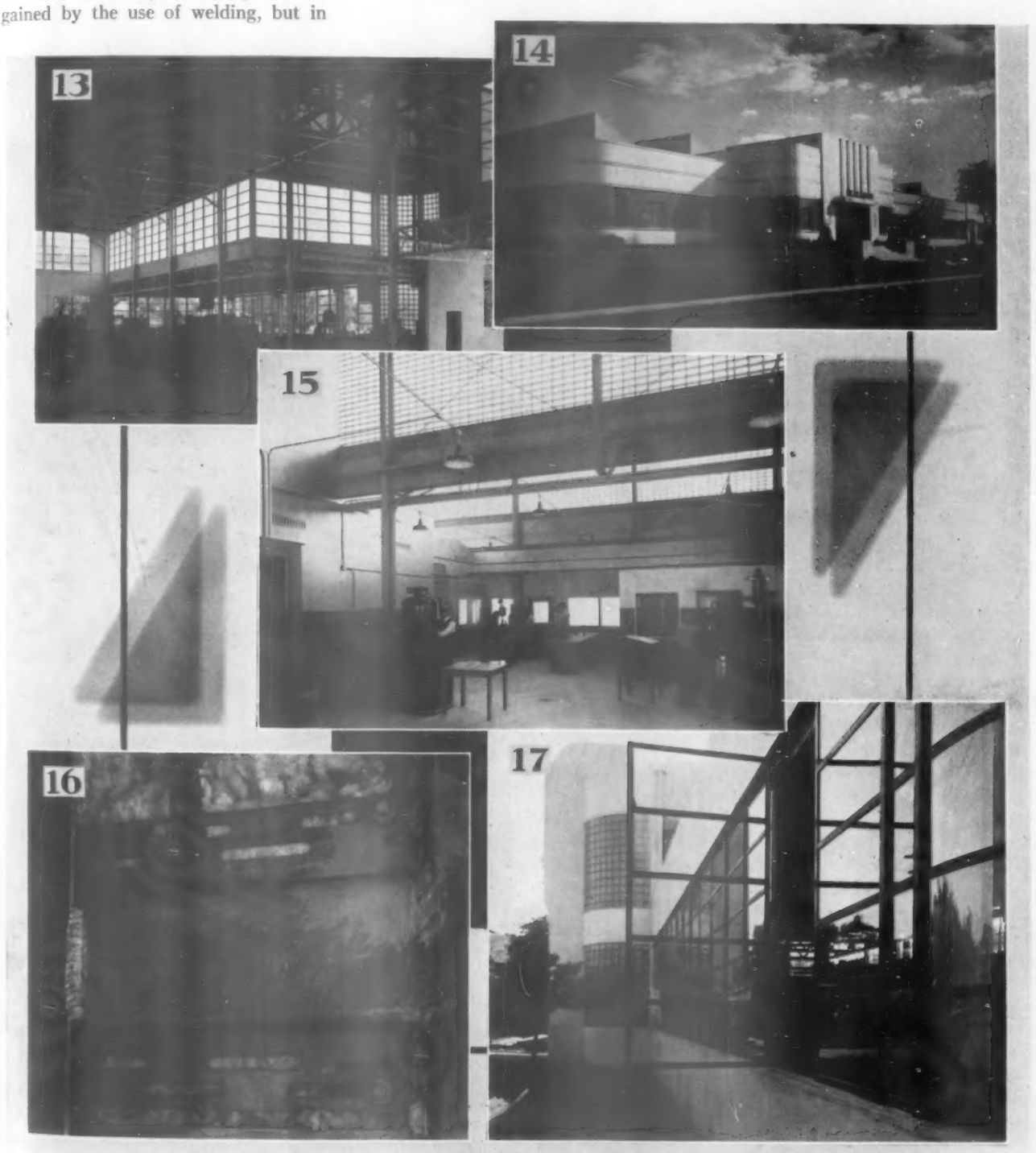
FIG. 13—Arc-welded steel factory for making prefabricated welded steel houses.

FIG. 14—Strikingly modernistic exterior of new Armco research laboratories.

FIG. 15—An abundance of diffused daylight streams into one of the testing rooms in new Armco laboratory.

FIG. 16—Clip strips for porcelain enameled panels are welded to building frame.

FIG. 17—Large windows can serve as air scoops to stimulate air circulation on warm days.



claim to have more welded buildings than any other city in its size group. When new projects are announced, the citizens who are welding minded (and there are plenty of them) form a committee and contact the owner and architect to sell the idea of welding instead of riveting. As a result of this kind of missionary effort, the city now boasts the following welded structures: Y. M. C. A.; Y. W. C. A.; Hotel Van Curler addition: State Armory; WGY Broadcasting Studio and an addition to the Ellis Hospital.

New State Armory

Hundreds of tons of structural steel for the new state armory at Schenectady, N. Y., were swung into place during recent months, but not a single riveter's hammer shattered the peace of the surrounding neighborhood. Within a hundred yards of the site are two hotels and a Y. M. C. A. housing hundreds of guests who would not have known that a large steel-framed building was being erected were it not for the change in the skyline.

In fact, the management of the Hotel Van Curler was so well pleased with the new silent method of erection that it distributed copies of the following announcement to its guests as one way of showing its appreciation: "Until recently, every steel building went clattering into the sky under the riveter's hammer and shattered nerves and throbbing ear drums were the result. Today, many steel buildings rise silently toward the clouds, with the soft whisper of the electric welding needle, and except for a change in the skyline you'd never know that hundreds of tons of steel were being fabricated.

"Although one of the most modern steel-framed armories in the United States is being erected only a hundred yards away, your comfort is not being disturbed by clattering hammers. This is because electric arc welding—the modern, quiet way of fabricating steel buildings—is used in place of riveting."

Welded Plate Girder

Figuratively "sewed together" by electricity the new Schenectady armory has three other unique claims to arrest the attention of engineers and construction men. It is said to have the largest welded plate girder and the largest welded arches of any building in the United States. Another feature is a continuous welded floor framing designed to increase the strength and stiffness of the floor.

The plate girder, 92 ft. long, was fabricated by the electric arc welding process. Sixteen feet wide, the smoothness of its surface is not marred by bolts or rivets or other projections. Over the drill shed, are seven huge arches with a span of 150 ft. The continuous type of steel frame has been used in the construction. Steel girders have been welded together in all directions, resulting in continuous beams extending the full length and width of the drill shed. In effect the beams act as a series of continuous suspension bridges.

This comparatively new method of steel construction has resulted in flowing lines of steel which give a unique character to the architecture of the armory. The technique has heretofore been tried on a smaller scale, and its use in the present instance is being watched with interest by builders.

With the welded structural work recently completed, the new home of WGY, General Electric's 50,000-watt broadcasting station, was finished ready for business about May 1, 1938. The steel structure of the new studio building was completely fabricated by arc welding. An illustration reveals details of the methods used to join cross members to girders. The holes in the top beams, which are barely visible, are for tie rods.

WGY's new home is of brick finish with glass blocks on the front. It is two stories in height. Five fully equipped, air-conditioned studios are included in the building with one studio two stories high and having a balcony for spectators. A unique installation is a studio equipped as a modern electric kitchen with refrigerator, range, dish washer, kitchen disposal unit and all the modern contrivances which help to make kitchen work easier.

First Welded Building To Be Erected Under New Code

By A. N. KUGLER*

★ Lehigh Construction Co. has started to build the first all-welded steel frame multi-story building to be erected under the new building code of New York City. This structure, to be known as Kensington House, is located at Seventh Ave. and 20th St., in lower Manhattan. Planned by H. A. Hyman, it will be a 14-story apartment house with all modern appointments.

Originally designed for riveted fabrication by Ball and Snyder, engineers, it was later revised to provide for welded construction. This revision of plans was done under direction of Gilbert D. Fish, consulting engineer and chairman of the American Welding Society's building code committee. Lehigh Construction Co., who have the contract for steel erection welding, have had considerable previous experience in this particular work. Gulick and Henderson, engineers, have been retained to inspect both the job and field welding in accordance with the building code.

Mr. Fish has provided some interesting data pertaining to this job. For instance, it is estimated that the total weight of steel in this building is 700 tons. The connection materials alone amount to 31¾ tons. Moreover, it is estimated that this job involves 11,869 ft. of welding of all sizes, including both shop and field welding. There is 8,173 ft. of shop welded joints and

Operators were required to pass qualification tests similar to those in the A. W. S. Code.

*Mechanical Engineer, Applied Engineering Department, Air Reduction Sales Co.

New York City building under erection involves 11,869 ft. of welded connections—69 per cent shop welded and 31 per cent field welded.

3,696 ft. of field welded joints. The shop welding consisted of three sizes of fillet welds—3,590 ft. of ¼-in., 3,309 ft. of 5/16-in. and 1,274 ft. of ⅜-in. welds. The field welding, while somewhat less in extent, involves one additional size of electrode. The estimated quantities of such welds are 2,065 ft. of ¼-in., 1,266 ft. of 5/16-in., 339 ft. of ⅜-in. and 26 ft. of ½-in. fillet welds. Seat angle connections are being used for joining the beams to other members.

It is, of course, too early to make an accurate cost analysis of the welding, but the first production figures available do offer interesting material for study. The early data reveals an average production of more than 7½ linear feet of equivalent ¼-in. fillet welds per man-hour.

Material costs approximating $.48 per hour include gasoline and oil used by the battery of five arc welding machines and electrode consumption at the rate of about 2¼ lbs. per hour.

The unionized structural steel welder receives $1.925 per hour, to which of course must be added the proportionate share per welding machine of the stationary engineer's time for operating the machine and helper's time for supplying materials. These are figured at 1/5 of the engineer's time at $1.75 per hour and 1/5 of the helper's time at $1.25 per hour. Altogether the total labor cost is $2.53 per hour, per welding operator.

Adding the materials cost of 48 cents per hour to the labor cost, the over-all approximate cost is 40 cents per welded foot. Undoubtedly, there are other cost items, which will raise this figure; such as, incidental labor, supervision, workmen's compensation and public liability insurance, overhead, profit, etc.

All welding operators on this construction job were required under the provisions of the building code to pass qualification tests substantially the same as the ones prescribed in the American Welding Society Code for "Fusion Welding and Gas Cutting in Building Construction." A battery of Wilson gas engine driven arc welding sets, supplied by the Air Reduction Sales Co., furnish welding current.

The approval of structural steel welding by the City of New York and other major cities foreshadows a new era in building construction.

Lincoln Electric Has New Daylight Factory

★ By elimination of cross members from the saw-tooth section of the new Lincoln Electric Co. plant recently completed at Cleveland, the structural designers have provided a maximum of useful and well lighted factory space. Constructed entirely of sections prefabricated by arc welding in the shops of The Austin Co., which designed and erected the plant, the building has welded rigid-frame construction, with continuous horizontal runs of glass block and sash and has a cement tile roof.

"Tree-form" sections, which are a distinctive feature of this new all-welded rigid frame plant, were developed by the Austin research department and fabricated at the company's Cleveland structural shops from plate and standard wide flange I-beams. The extent of prefabrication is illustrated by the fact that of 29,600 lineal feet of welding required for the job, only 4,600 feet were welded on the site.

An illustration details the manner in which floor beams at the second story level are welded. By looking upward at the roof girders, which are temporarily bolted to the "tree-form" columns, the reader can see the space which is still to be closed by welding.

In sharp contrast with the situation in conventional plants, each aisle across the 100,000 sq. ft. second floor is clean as a gun barrel from floor to roof; entirely free of cross-members which would limit head-room and block the even distribution of light. Four 40-ft. aisles of this sawtooth type, ranging from 240 ft. to 440 ft. in length, and a lofty "cathedral" shop with 80 ft. clear span have been provided and are flanked by flat-arched aisles along the side walls.

A series of parallel bands of brick, glass block and projected steel sash, with stripes of stone between them forming sills and lintels, encircles the exterior in a striking horizontal sweep.

FIG. 18—Welding cross angles for roof stiffeners of welded frame for large diesel locomotive plant recently built near Chicago.

Welding operators making frames for direct-current motors and generators.—Photo, courtesy of General Electric Co.

Second of a series

of practical lessons in

Technique of Arc Welding

★ Part 2—Types of single beads to use and advantages of two kinds of half-circular weave motions—How to get good penetration

By ROY OWENS

Welding Instructor, Electro-Motive Corp., LaGrange, Illinois

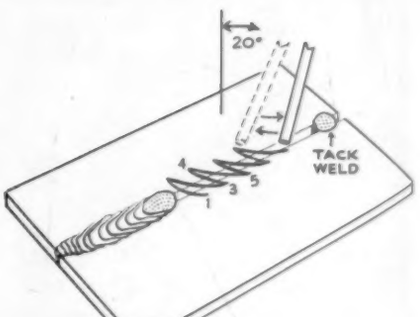


FIG. 7—Motion which is used on butt joints that are not vee'd out; also for the first pass in the bottom of a vee. Sometimes called a stringer bead.

FIGURE 7 is similar to a straight bead as shown on page 30 in the April, 1938, issue, with the exception that a back-and-forth motion is added which keeps the molten metal and slag washed back out of the crater and allows the arc to penetrate much deeper. This motion is very good when used on joints that are not vee'd out and on close fits, because the heat is not spread out, but is kept in the line of weld. A small size electrode will give best results, using maximum heat for the size of electrode—1/8-in. or 5/32-in. Use a reversed polarity all-position electrode. If a different type of electrode is used, an excess build-up and insufficient penetration will result. Inadequate current will have the same effect.

If a higher build-up is desired, increase the stroke length until the proper height is reached. By shortening the stroke a flat weld can be obtained. This particular motion can be used in all positions and gives a very efficient weld as well as an economical one for a close arc. This method will give off very little spatter. More heat can be obtained at the arc and it can be confined to a small area.

Another good use for this motion is for the first pass in the bottom of a vee, sometimes called a stringer or sealer bead as shown in Fig. 8. With the use of a 1/8-in. electrode and 150 amp. or 5/32-in. electrode and 200 amp., the operator can get complete fusion in the bottom of the vee. If larger electrodes are used, there are chances of incomplete fusion in the bottom of the vee, due to molten metal flowing ahead of the arc and down into the vee, which may have the appearance of good fusion. When such a weld is given the bend test, it will show that the metal did not fuse with the parent metal in the bottom of the vee.

Another important factor is the position of the electrode as shown in Fig. 7; the top end of the electrode is 20 deg. ahead of the bottom. This will serve two purposes. First, there is a certain amount of gas pressure or arc blast built up at the arc and this will help to keep molten metal blown back out of the crater, thus allowing the arc to penetrate deeper into the parent metal. Second, the operator can get a better view of the entire crater and

FIG. 8—First pass or stringer bead in a vee'd joint.

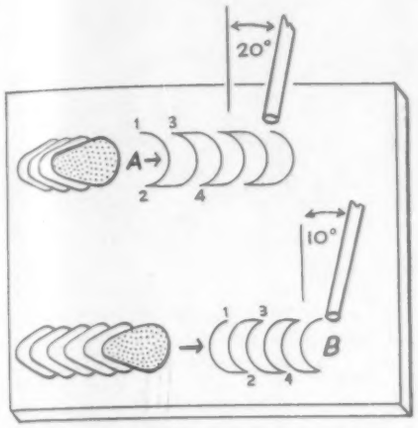


FIG. 9 (A)—Half-circular weave motion recommended for second pass on vee'd butt welds.

FIG. 9 (B)—Weave motion recommended for building up worn surfaces.

its depth, which will indicate the amount of penetration. If the electrode is carried at too great an angle, the result will be excess spatter, irregular ripple on bead, poor penetration, excess build-up and a steep shoulder.

Half-Circular Weave

Figure 9, motion A, is similar to Fig. 7, but has a half circle motion added, which makes a wider bead, but one which has the characteristics mentioned in Fig. 7. This motion is recommended for the second pass on V butt welds as shown in Fig. 16. Good fusion can be obtained by increasing or decreasing the length of stroke. Any build-up desired can be obtained. This motion is also used on single-pass butt welds on 3/16- and ¼-in. material (no vee groove but spaced ½ plate thickness) where a wide weld is desired as shown in Fig. 15.

Figure 10 shows side view of motion A at the center of half circle, the electrode being below the surface of parent metal. The stroke then continues toward the dotted line, which indicates the electrode at the end of the stroke. It is drawn above the surface of the parent metal, but this does not mean that the arc is of excess length, because the filler metal will form the same angle and the arc will maintain the same length at all points of stroke. If dotted line indicating electrode were half the distance forward as shown, it would mean that the filler metal would be approximately half the original height. By increasing or decreasing the radius the width of bead can be governed.

This motion can be used with any size electrode, depending on the size of the job and the amount of filling. Straight or reverse-polarity electrodes can be used, but for better penetration and less build-up, a reverse-polarity electrode will give best results. With this motion less trouble will be encountered with slag inclusions. The only time this might occur is when the arc has been broken and when starting a new arc without first cleaning the slag out of the crater.

Building-Up Weave

Figure 9, motion B, is exceptionally good for building up worn surfaces, but is not recommended for good penetration. This is good on poor fits and large openings between parts to be joined. This motion is the same as the previous motion, except that the half circle motion is reversed and the electrodes are held straighter with only 10 deg. slant ahead of the weld.

Figure 11 shows side view of motion B. This sketch shows electrode above the surface of parent metal at front of stroke and slightly higher as electrode continues back on the half circle to center of stroke. From there to finish of stroke the electrode returns to similar position as at start. On large openings the motion spreads the heat on either side of the opening and the cross stroke will bridge the filler metal across the opening. Metal will solidify between strokes and will not fall through. With this motion less current will be used than normally for the size electrode used. The height of build-up on this motion will depend on

FIG. 10—Side view of motion A in Fig. 9.

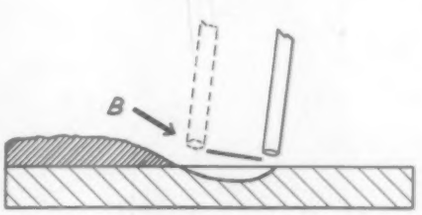


FIG. 11—Side view of motion B in Fig. 9.

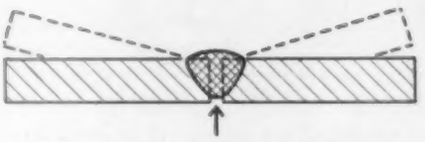


FIG. 12—Weld lacks penetration at bottom of plate.

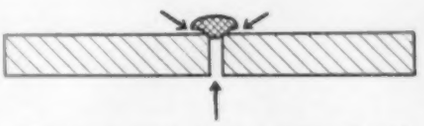


FIG. 13—A weld of poor quality. Should be chipped out and rewelded.

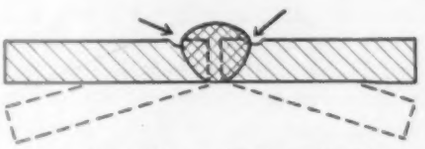


FIG. 14—Weld of good penetration, but badly undercut on each side.

the operator and size of electrode, also the current setting. This motion is also used successfully on vee butt welds for the second pass as shown in Fig. 16. Caution must be exercised to see that the slag doesn't collect in the crater and become covered or partially covered. This will leave slag holes in the weld. The more current used for a given size electrode lessens the chance of covering the slag. The reason is that more metal is molten and it is heavier than the slag. Therefore, the slag will float to the top of weld.

Gas and Slag Holes

At this point it will be well to mention the difference between gas and slag holes. Gas holes are usually caused by improper cleaning of metals before welding and some foreign matter being covered with molten metal. This forms a gas and the gas will blow a hole through the molten metal in order to escape. While it is escaping, molten metal will solidify and result in gas or blow holes. Another cause is welding on heavy sections of cold metals, the filler or added metal will be quenched as soon as it comes in contact with the parent metal and will solidify before it can flow together, thus causing small pin holes. To overcome this it is advisable to preheat the work before starting to weld, or to use a larger electrode and heavier current, or to travel slower and if trouble is still encountered to hold a slightly longer arc to allow the heat to spread.

Figure 12 shows a neat appearing weld from the top side and is feath-

FIG. 15—Single-pass butt weld with good penetration, average build-up and uniform bead.

FIG. 16—Double-pass butt weld commonly used. Second pass anneals first pass and refines its grain structure.

ered out at the edges without any under cut and has the correct build-up. However, this weld lacks complete penetration at the bottom of plate as indicated by the arrow. If the plate were bent as indicated by dotted line the weld would break at point of arrow. To correct a weld of this kind it should be chipped or vee'd out and welded from the other side. The reason for chipping before welding is that there is always slag and scale to interfere with the quality of the weld. Also, since this side of the weld was not protected by shielding gases from the atmosphere, there will be some oxidization and by vee'ing out, this will remove any scale or oxidized metal and the operator will find his job less difficult. The weld will possess greater tensile strength.

Figure 13 shows a weld of poor quality. Nothing good can be said of this weld due to the fact that it has no penetration, very little fusion, overlap and excess build-up. This usually is caused by a careless or inexperienced operator, insufficient current or an arc of excess length. Welds of this type have done more to retard the progress of welding than any other factor. Such welds should be discouraged to the utmost. Jobs like these should have the weld chipped completely out and be rewelded.

Cause of Undercutting

Figure 14 shows a weld with excellent penetration and fusion but which is undercut on each side of the weld. This is generally caused by excess heat or by the motion used. By moving electrode away from the sides of the weld too fast, the filler metal doesn't fill the crater at the edges and if the plates are bent (as dotted line indicates) the weld will start to break at each edge. To remedy a weld of this kind, clean thoroughly and run a small stringer bead at each edge of weld to fill the undercut.

Figure 15 shows end view of a single-pass butt weld (no vee groove) with complete penetration and fusion with average build-up and uniform bead. A weld of this type should always be the operator's aim.

Figure 16 shows a double-pass weld (plates vee'd out) which is often used and gives excellent results. When second pass is made it will anneal the first pass and is generally said to give the weld greater ductility, as well as a refinement of the grain structure of weld metal previously deposited.

(Third instalment of Mr. Owen's series of articles will be published next month.—Editor.)

High Efficiency Ventilating Fan Built By Arc Welding

★ Shown in the accompanying illustrations is a large size ventilating fan manufactured by the La-Del Conveyor & Mfg. Co., New Philadelphia, Ohio, particularly for use in the ventilation of coal mines. One illustration (Fig. 1), shows the fan coupled to a wind tunnel. The tunnel is provided with complete means for introducing resistance of varying degrees against which the fan being tested is to operate and with very complete means for measuring the pressure and velocity of the air blowing through it. According to leading aerodynamic engineers this type of wind tunnel, manufactured for testing purposes, is the most complete in use in the United States today.

The fan is designed by Dr. Theodor Troller of the Guggenheim Airship Institute at Akron, Ohio. It is a propeller type fan equipped with adjustable pitch blades and capable of producing pressures in excess of 10-in. water gauge. The fan, when installed at the mine, will be driven by a 200-hp. motor. Dr. Troller has specialized in propeller design and is said to be the first aerodynamic engineer who has reduced to exact mathematics, the science of designing propeller blades.

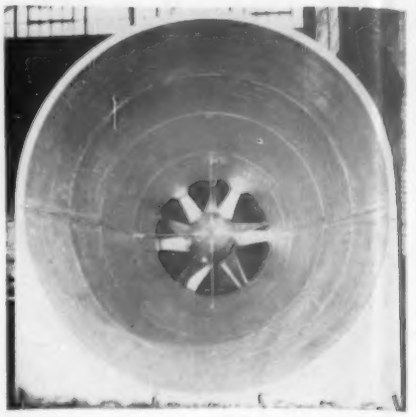


FIG. 1—Ventilating fan of arc-welded steel construction for coal mine, coupled to wind tunnel for testing.

The complete fan casing, fan ring, nosing, tail and stack are of arc welded steel construction. There is no riveting employed in the fan, or any part of the exhaust stack. One of the illustrations (Fig. 2), shows the degree of streamlining employed in the fan which is so important to its high efficiency. It would be difficult in fact, perhaps impossible, to realize the degree of streamlining built into these fans without welding, since riveted joints would raise obstructions along these surfaces. The welding was done with shielded arc equipment made by Lincoln Electric Co.

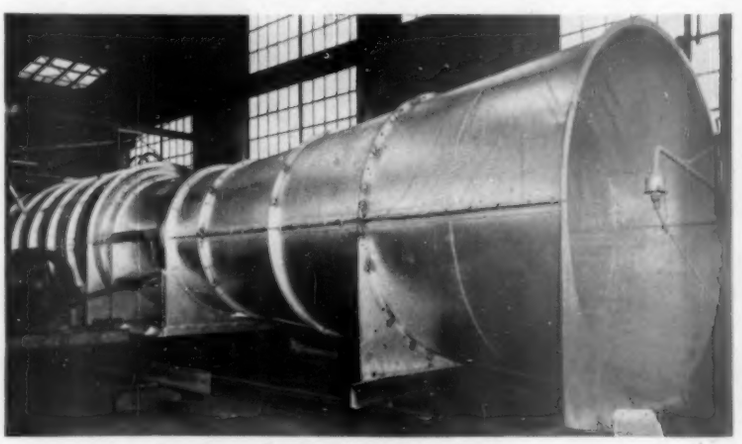


FIG. 2—Streamlining effect and smooth surface would not be possible except with welded construction.

Welding—Major Tool of Industry

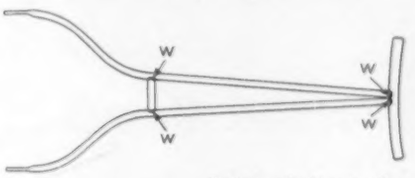
Welded Tubular Steel Handles Used On Lawn Mowers

★ Lawn mower handles have been made of wood for so many years that the thought of any other kind of a handle just never occurred. Recently, however, one progressive company conceived the idea of fabricating lawn mower handles from tubular steel by welding. The result was a decided improvement over the old type handle.

Tubular steel, welded into one permanent unit, has several advantages over the wooden handle. In the first place, welded steel tubing effects a considerable reduction in weight and produces a trim, smooth handle. Both of these factors are important in making the lawn mower easier to use. In the second place, welding provides jointless construction which eliminates maintenance and gives longer life to the handle. Welding also enables economical fabrication and thus makes it possible to keep the cost of tubular handles on a comparable basis.

Before the tubular parts reach the welding department, several mechanical operations are necessary to prepare them for welding. The tubing arrives at the plant in various sizes and standard lengths. These sizes are then cut to special lengths and routed to the machines which will bend, grind, punch and crimp the tubing in several ways.

The handle grip is bent to correct curvature and turned in at the end. This eliminates any ragged edges and protects the hands of the user. The extension pieces are bent to curvature, ground at one end to fit the side of the handle grip, and punched at the other end to be attached to the lawn mower body. The small section of tubing that spreads the extension pieces is ground at both ends to fit the sides of these extensions. The various parts are then sent to the welding department in lots of sufficient quantity to enable steady production.



Letters indicate the location of the four welds.

Finished handles, inspected and ready for shipment.

The welding department assembles and welds the pre-formed tubing.

In the welding department, a tack-welding operator places the parts which make up the handle assembly in a jig, tack-welds the various parts together and then places the assembly in a rack, which is so located that it is readily convenient to the three production welding operators.

Only four welds are required in producing the handle assembly. These welds are indicated by the letters "W" in the accompanying sketch. A sheet metal oxy-acetylene blowpipe and suitable rod are used by the operator, and no jigs are necessary in making the

finished weld. Production time is further reduced by the fact that the welded joint has a smooth appearance and requires no subsequent finishing.

When completed, the assemblies are stacked for inspection and shipment. During inspection, a rubber mallet is used to remove any twists or curves that the handle may have received.

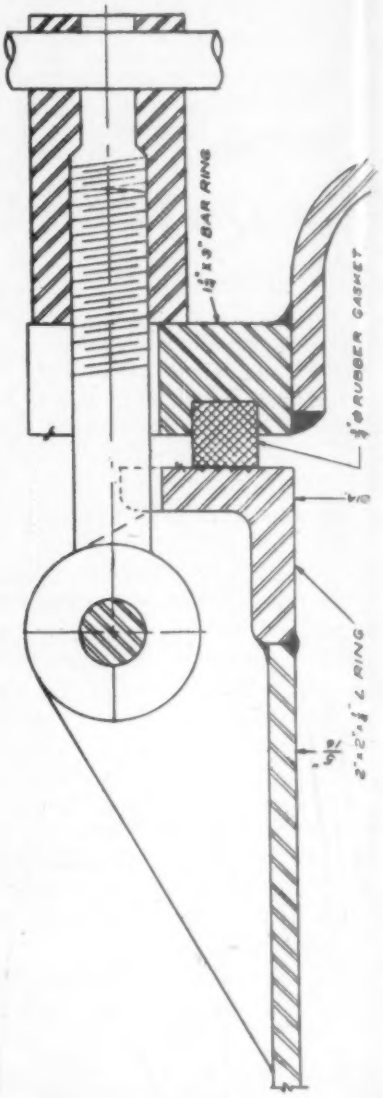
The use of welded construction has made it possible for this company to produce a strong, lightweight product having a neat and attractive appearance. In addition, the engineering and production problems have been simplified by designing the product for welding, and production time and costs have been reduced.

Welded Vacuum Tank For Aeroplane Radio Tests

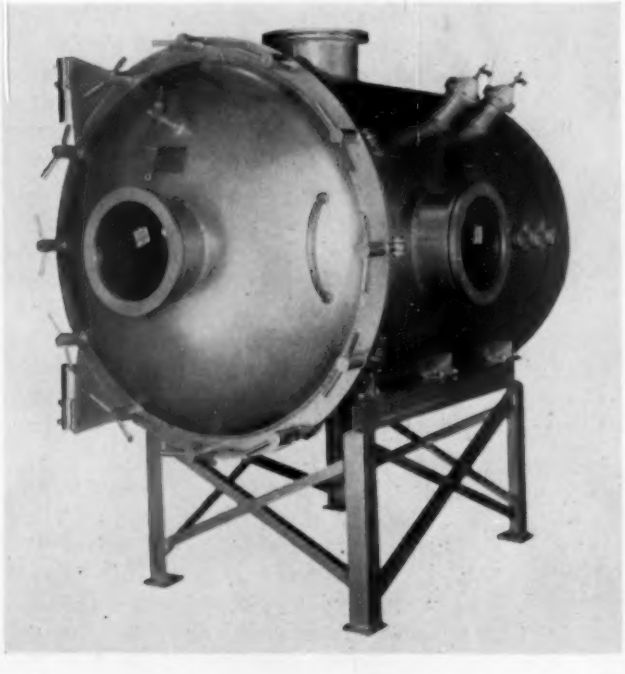
★ The controlling bodies of the government exercise every possible care in supervision of the commercial air lines so that the traveling public is assured of safe passage. One stipulation is that all radio equipment must be tested and prove its ability to function properly at the various altitudes at which planes operate up to 30,000 ft. Of course, it would be possible to make such tests on planes in flight, however, such a procedure would be both slow and expensive. United Air Lines, one interested company in the air transportation field, evolved a plan by which the necessary tests could be made on the ground.

They determined that a leak-proof container of sufficient size in which a vacuum of varying degree could be created, would give conditions within the container comparable to various altitudes of planes in flight. They drew up a plan covering such a container and gave it to the Chicago Boiler Co., 1965 Clybourn Ave., Chicago, Ill., for execution. The finished unit is shown in an accompanying illustration. In considering the fabrication method to apply, the use of the container was kept in mind. Because the unit had to be absolutely air tight, welding was specified.

The circular shell, which is of 5/16-in. open hearth plate was the first part fabricated. After cutting to proper width and length, it was put through bending rolls to form it into a shell 48 in. in diameter with a length of 5 ft. The longitudinal seam was then spaced with an opening of about ⅛-in. for a butt weld, and tacked in sufficient places to hold it firmly while the weld was made. The thickness of the material was small enough so that a vee'd joint was not necessary. One pass with a ¼-in. shielded arc electrode was made on each side of the joint with sufficient amperage to secure complete penetration.



Details of vacuum-tight connection between the shell and cover head.



Welded vacuum chamber for testing aeroplane radio equipment used by United Air Lines.

The next step was location of inspection holes of which there were five —one on top, two on the sides, one in the end and the fifth in the cover head which will be described later. These were made with the oxy-acetylene cutting torch and were 12-in. in diameter. Plate of the same thickness was cut and shaped in the proper dimension and then inserted through each opening, not quite flush with the inside face of the shell. Two fillet welds were then run, one at the outside junction on the two pieces and the second on the inside. Rings for mounting the glass in the inspection holes were

shaped with the oxy-acetylene machine cutting torch. That which fastened to the shell proper was of ½-in. material and the cover ring was of ⅝-in. Both were drilled and tapped and the cover ring countersunk for the required tightening screws. The glass proper was set in materials suitable to keep it from breaking and to secure a proper seat for a leakproof joint.

Other openings in the shell included two 3-in. sections of pipe in which were inserted insulated brass rods for the required electrical connections. Three 2½-in. forged steel welding flanges were also attached as well as two ¾-in. flanges. Twelve threaded tightening screws were equally spaced around the open end for the purpose of tightly closing the cover head. Details are shown in the accompanying drawing.

It was necessary to give careful consideration to the joint between the shell and cover head, which had to be leakproof. A 2 x 2 x ½-in. angle of proper length was run through bending rolls to give it the same inside diameter as the inside diameter of the shell. It was positioned on the open end of the shell and tacked in place. One weld was run on each side of the junction as shown in the drawing. The face of the angle was then machined for even surface.

The cover head was dished from ⅜-in. open hearth plate with a flange of the proper depth for accepted welding practice. A 1¼ x 3-in. bar ring was then positioned on the dished head (see diagram) and joined by two fillet welds. A groove was machined in this ring for the purpose of inserting a soft rubber gasket which when pressed against the angle ring assured a leakproof joint.

An inside loading platform consisted of two angle plates each 4 x 6½ in. and five feet long which were tack-welded in place. The stand for the shell was made from two 4-in. x 7.7-lb. I-beams which were welded to legs cut from 3 x 3 x ¼-in. angles cross supported by 1½ x 1½ x 3/16-in. angles. In all, this job required in the neighborhood of 200 ft. of welding, all of which was done with shielded arc electrodes to secure joints of sound weld metal made in the least time consistent with good practice.

When the unit was delivered to United Air Lines it was given a test in which a 28½-in. vacuum was created, equaling atmospheric conditions at a height of 67,000 ft. While subjected to this great pressure from the outside there was no evidence of failure of any welds nor any leaks. Some idea of the pressure exerted was shown by the special ½-in. glass in the inspection holes which was dished ⅛-in. at the center of a 12-in. unsupported diameter.

Simple Time-Temperature Tests of Electrode Holders

By T. B. JEFFERSON*

★ Why not test welding accessories? The operator, the rods and the machines are all thoroughly tested before they are placed on a job. In view of these tests why shouldn't the rest of the welding equipment necessary to accomplish the tasks at hand be tested?

Some of the trouble experienced in the welding shop and for which the welding operator is frequently blamed can be attributed to the equipment with which he has to work. As a result we learn the truth of that old saying, "He does the best he can with the tools he has." In the case of electric arc welding the trouble which is usually experienced may be attributed to either the machine, the electrodes or the electrode holders. Of these three causes, the electrode holder is probably the least thought of, yet most frequent offender.

It is not unusual to see a welder interrupting his work to cool his electrode holder in a bucket of water, or at the close of the day to see him discarding a pair of gloves which have become charred. In either case these actions are brought about by the excessive heat which is developed in the handle of the electrode holder during a welding operation. Another cause for welding difficulties may be attributed to the design of the holder which may make it impractical for use in all welding positions. Inasmuch as all of these experiences result in inferior products and slower production an effort should be made to overcome the cause of such faults in workmanship.

One way to insure obtaining a comfortable, as well as efficient, electrode holder for the operator is to purchase this item only after it has satisfactorily passed an acceptance test. A test which has recently been developed for this specific purpose has been so simplified that it is suitable for every shop owner's use. Unlike most methods of testing materials and equipment, no expensive testing equipment is required to assist in determining the fitness of an electrode holder. The entire test can be made using only such equipment as is commonly found in the toolroom of a job welding shop.

The holders are first tested to determine if they are capable of gripping and holding various size electrodes for use in all welding positions. Since much of the work undertaken in a job shop is of a varied nature this is an extremely important requirement. To determine if a holder possesses these qualities it is merely a matter of ascertaining if it is capable of gripping electrodes varying in size from ⅛ in. to ⅜ in. in diameter in a manner such as to permit welding in all positions with ease. After having satisfactorily passed this requirement, the holder is then subjected to a practical temperature test.

This test has been developed to ascertain if the holder is suited for uninterrupted service over a protracted

*Engineer-in-Charge, U. S. Engineer Shops, Fort Peck, Mont.

FIG. 1—Electrode holder, with handle wrapped in 3/16-in. asbestos, ready for practical temperature test.

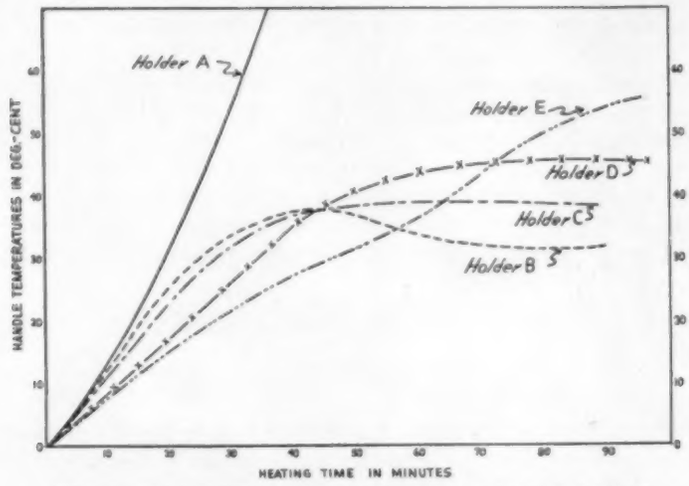


FIG. 2—Time-temperature curves of five electrode holders which were tested.

period. The procedure consists of passing a continuous current of 200 amp. through the holder for a period of 1½ hrs. During this time the handle of the holder should not show a temperature rise of more than 40 deg.

The temperature rise is taken by means of a thermometer placed inside the handle of the holder, the handle having been wrapped previously with a single sheet of 3/16-in. thick asbestos. The holder is insulated in this manner, because as nearly as can be determined, this duplicates conditions existing during welding. It is believed that the insulating effects of 3/16 in. of asbestos are approximately the same as that offered by a welder's gloved hand. Figure 1 shows an electrode holder which has been prepared for the practical temperature test.

When five nationally-advertised electrode holders were subjected to these comparatively simple tests some startling disclosures resulted. While all of the holders tested were capable of gripping the electrodes in the required positions, only two stayed within the 40-deg. C. temperature rise limitation.

Figure 2 gives the time-temperature curves of the five holders tested. For the purpose of concealing their identity they have been designated as holders A, B, C, D, and E.

Holder A was removed after 35 min. of testing, because at that time it had become so heated it appeared impractical to carry the test of this holder any further. During the testing of Holder B there was a drop in room temperature of 15 deg. F. It is believed that this tends to account for the downward sloping tendency of the curve of this holder after 45 min. of testing. Upon making a temperature correction on this curve to compensate for this change in the test room temperature, the correct 1½ hour temperature rise on Holder B would be approximately 39 deg. C.

In an effort to further determine the value of a time-temperature test Holders A and C, apparently the poorest and best holders, respectively, were placed in actual service. On this occasion both holders were used on the same type of work using the same size of rod. As nearly as could be determined they were subjected to similar working conditions. The object of this trial was to determine the actual life of the holder and to see if there was any relationship between the length of service and the time-temperature curves.

The outcome of this trial appeared to prove conclusively that the time-temperature characteristic of a holder presents a true index of the service that may be expected from a holder under actual working conditions. Electrode Holder C proved to be far superior in that it was in service 415 hours before being replaced. During this time 1,215 lbs. of welding rod was deposited. Holder A, however, deposited only 275 lbs. of rod during the 102 hours it was used before burning out. Furthermore Holder C was readily reconditioned by the replacement of a small wearing part and was suitable for additional service. Holder A, however, was damaged beyond further use as the result of this working trial.

Low-Current Welder Eliminates Warping

★ Among the most important products fabricated by the Frauneder Ornamental Iron Works, Oakland, Calif., are decorative panels for doors and store fronts. The company has, for some time, employed welding as an economic and efficient tool. But they have found that, while their large welder would do the job, the resultant heating warped the panels—and it cost $1.50 to straighten each panel after welding was finished.

The answer to the problem was to suit the welder to the job. The company now does the work with a General Electric Mutator welder. Since installing this equipment, they have produced 350 panels, each one requiring 65 welds. Out of the total of more than 22,500 welds thus made, it is claimed that only two failures have been encountered and both of these were avoidable. More significant, however, is the fact that warping has been eliminated entirely. In eliminating warping, the new welding equipment has saved the Frauneder Ornamental Iron Works $525 to date, more than three times the original cost of the welding equipment. Perfect welds are obtained with low current input, small electrodes, and the job can be done 20 per cent faster.

Low-current arc welder cuts costs and increases welding speed 20 per cent.

New Product Developments

Hobart Improves Its Line of "Multi-Range" Arc Welders

★ "1,000 Available Combinations of Voltage and Welding Current" is the keynote of an announcement of a new line of "Multi-Range" arc welders made by The Hobart Brothers Co., Troy, Ohio. It is pointed out that the new models embody the same principles of control as previous models, but that the wide welding range of each machine is now divided into ten ranges with a 100-step, rheostat operating in each range.

The result is said to be a complete absence of "dead spots," closer control of the relationship between open-circuit voltage and welding current, and smoother operation. Oscillograph tests and reports from operators also indicate improved stabilization as a result of the special windings, extra turns and added copper which provide the correct reactance for each of the ten welding ranges. The reactance may thus be said to be "automatically varied to suit actual welding requirements."

Hobart "Multi-Range" Arc Welder.

Hobart's "remote control" feature is retained and improved. The volt-amp. adjuster is now located compactly within the ten-range dial, where it automatically plugs in or out when used on the machine or at any distance away. Only a lamp cord extension is required to place the volt-amp. adjuster close to the hand of the operator, wherever he may be working. This saves many steps and insures better welding by removing the temptation to "get by" with one machine setting for different welding positions or rod sizes.

The welding ranges are easily selected by turning a large hand wheel (of steel covered with hard rubber) conveniently located on the front of the "turret top" control cabinet, while the indicating dials are clearly and attractively marked in colors of black, red and silver. Separate voltmeter and ammeter are also provided (optional with "Junior" models), flush mounted on the front panel.

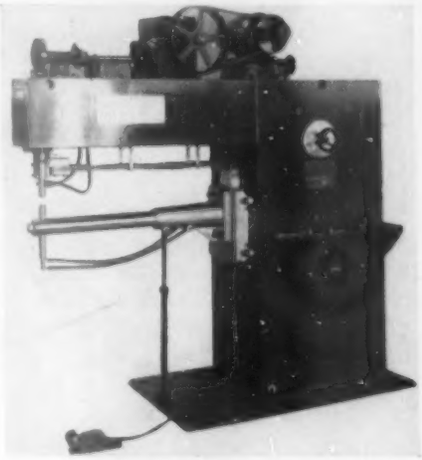
The new "multi-range dual control" models are said to have been in development for two years and many have been in actual use for nearly one year on various kinds of work. This service experience brought about only a few changes in design and the complete new line is now in production. Hobart "multi-range" arc welders are available in "Junior" models with built-in electric motors in 100 and 150 amp. ratings, or with self-starting gasoline engine in 200 amp. rating. "Senior" models include 150, 200, 300, 400 and 600 amp. electric drive, 200, 300, 400 and 600 amp. gasoline engine drive and 200, 300 and 400 amp. generators only for connection to customer's own gasoline engine or electric motor.

New Spot Welder Has Variable Speed Drive

★ Eisler Engineering Co., 749 So. 13th St., Newark, N. J., has recently developed its Model 600-CFO spot welder. New features are included which have not heretofore appeared in previous models of the company's line, it is stated. This machine is manufactured in sizes from 35 to 500 kva.

Except for the driving arrangement, the welding mechanism is completely enclosed in a fabricated box-type frame. The ¾ hp. variable speed drive and safety clutch permit a range of from 20 to 150 strokes of the upper electrode per minute. Operation of the upper electrode is straight up and down.

Mounted on the same camshaft as the overhead driving cam is an additional cam which acts as a timer in regulating duration of current. Even though this cam is adjustable, an automatic timer is supplied with a contactor for more sensitive control.



New Eisler Model 600-CFO spot welder.

Throat depth of the machine is 36-in. but any other depth between 12-in. and 48-in. may be had. The lower electrode is adjustable both horizontally and vertically. Water-cooled electrode holders are standard equipment. A single-phase welding transformer for 25, 40, 50, or 60 cycle service can be supplied.

New Electrode for Welding Manganese Steel

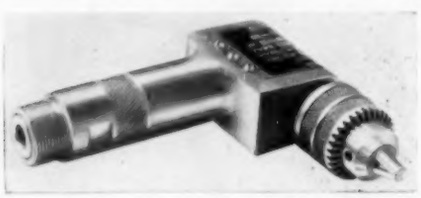
★ The Harnischfeger Corp., Milwaukee, Wis., announces Smootharc "Harmang"—a new addition to the line of Smootharc welding electrodes. Designed for welding on parts subject to heavy impact, such as manganese castings, railroad frogs and crossings, dipper teeth, etc., "Harmang" will supply the necessary toughness and hardness. Its base metal is nickel manganese steel, ranging from 11% to 14% manganese, 3½ to 4½% nickel. Carbon content is in excess of 1%.

The slag coating which stabilizes the arc and protects the metal against loss of carbon and manganese is kept to a minimum, so as not to interfere with the rapid cooling required to form an austenitic deposit. With cold working such as hammering and peening, the soft manganese deposit becomes an extremely hard martensite layer which offers great resistance to impact and abrasion. Smootharc "Harmang" operates with the work negative and the

electrode positive, and is built in sizes from ⅛-in. to ¼-in. diameter, for use with currents ranging from 90 to 140 amp. Further information concerning this new welding electrode may be obtained from the Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

Close-Corner Angle Head for Flexible Shaft

★ Especially designed for drilling and filing in close quarters, the Series 420 close-corner angle head for flexible shaft connection, has been developed by Stow Mfg. Co., Inc., Binghamton, N. Y. This new angle head is equipped with miter gears, and ball thrust bearings adaptable to flexible shafts No. 1A, 2A, or 3A. It is furnished with ¼-in. Jacobs chuck for drills, rotary files, rasps, mounted wheels, etc.



Series 420 angle head for flexible shaft operation.

New Vacuum-Packed Can for Welding Electrodes

★ Smootharc welding electrodes are now being packaged in a new vacuum-packed can. This is said to end the problem of how to keep welding electrodes fresh for an indefinite period of time. The electrodes are taken from the drying ovens and immediately placed in these containers. Tops are hermetically sealed and the contents remain in "oven-fresh" condition regardless of the moisture present in storage facilities.

This new container allows the large consumer to buy electrodes in quantity and store them safely. It also means a distinct advantage to welderies which use small quantities of electrodes, by enabling them to stock a reserve supply as rapid stock turnover is no longer necessary to insure consistent quality of electrode coating.

Further information about these electrodes and their new container can be obtained by writing to Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

New vacuum-packed container.

New Clear View Safety Goggle

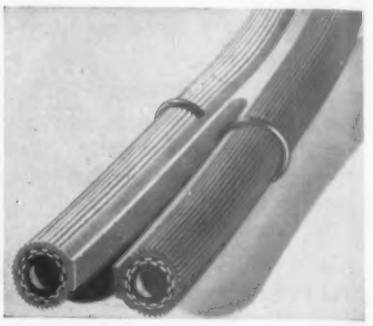
★ A new type spectacle goggle, equipped with super-tough lenses and designated as Style WVI, has just been added to the line of goggles manufactured by Willson Products, Inc., 274 Thorn St., Reading, Pa. Designed for maximum protection and comfort, this new goggle is available in various assemblies to suit the individual requirements of the wearer and is particularly applicable for use in industries where flying objects present a serious eye hazard.

Goggle has wide-view lenses and rocker nose pads.

The illustration shows the goggle equipped with clear, wide-view lenses and rocker nose pads. It is also made with a comfortable broad saddle nose bridge.

Electric-Siameez Hose

★ Electric Hose & Rubber Co., Wilmington, Del., originators and makers of the Supero-Siameez hose, now announce Electric-Siameez hose—a new grade using the same Siameez construction. This hose has two lines of high quality "regular" two-braid hose, joined together by the same integrally-molded web as "Supero" and "Junior" Siameez grades.

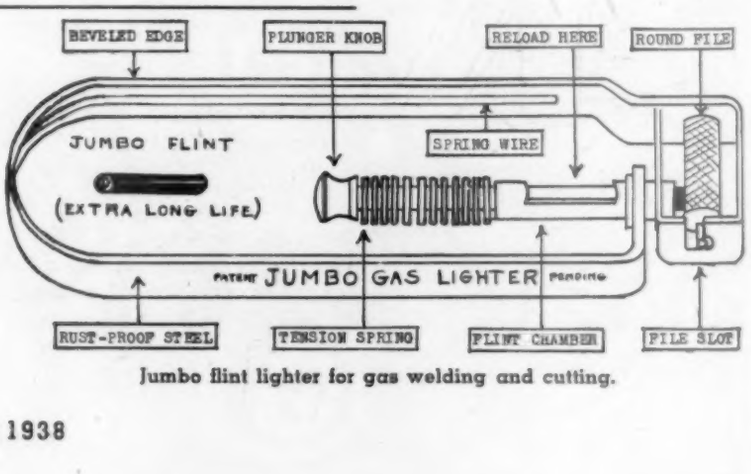


Electric-Siameez hose is recommended for pressures up to 200 lbs.

The cover of the new hose is thick and tough, to withstand dragging over castings, concrete floors, etc. It is made in ¼-in., 5/16-in., and ⅜-in. sizes. End separated at the factory if desired, for attachment to equipment.

Jumbo Flint Lighter

★ Designed exclusively for oxy-acetylene welding and cutting, the Jumbo flint lighter is offered with the claim that it has a frame which will outwear any 12 ordinary lighters. It is further claimed that the flint will outlast 5 to 7 times the ordinary flint. Each part of the jumbo lighter can be purchased separately. The complete lighter sells at a nominal cost and replacement



Jumbo flint lighter for gas welding and cutting.

flints are available in three sizes: large, medium and small. Harris Calorific Sales Co., 136 Liberty St., New York City, is handling distribution of the Jumbo lighter. Exclusive agency territories are available in some sections of the country. Further information will gladly be furnished by Harris Calorific Sales Co.

New 150-Amp. Vertical P & H-Hansen Welder

★ The Harnischfeger Corp., Milwaukee, Wis., announces a new machine—the 150-amp. vertical type welder. Designed to occupy a minimum of floor space, this new welder is an adaptable machine, available for a wide range of work in welding the lighter gauge metals, both ferrous and non-ferrous. With plug-in type cable receptacles for easy current reversing, and patented, single-current control, it is claimed to set a new high in simplicity of welder operation. It is designed for high current uniformity, and is suitable for use in the production welding line where smooth, uniform welds are essential.

New P&H Hansen 150-amp. vertical arc welder.

Furnished in a-c. drive only, this machine is less than 4 ft. in overall height. An ingenious towing handle provides easy movement around the shop, and ample stability when raised to form a 3-point base. Proper ventilation and cooling is provided through the fresh air intake at the top, and the exhaust at the bottom. It can also be furnished with lifting ring and without wheels where portability is not necessary. Further information may be obtained by writing the Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

"Herco" A-C. Arc Welder

★ A new a-c. arc welding machine has been developed by the Hercules Electric & Mfg. Co., Inc., 24 E. 22nd St., New York City. This "Herco" welder is designed primarily for production welding by the shielded arc process.

"Herco" a-c. welder has automatic current control.

The Herco operates on either 110 or 220 volts a-c. at 50 or 60 cycles. The Herco has a new automatic current control which prevents overheating or burnout. By means of this control a steady flow of current is produced resulting in a stabilized flexible arc. The capacity of this machine ranges from 15 to 142 amp. which makes it suitable for welding girders to thin sheet metal.

The Herco welds all forms of steel, cast steel, iron, cast iron, aluminum, etc. All the features of this machine are also available in 180 amp. and 250 amp. models. The power generated by this "mighty mite" makes it suitable also for cutting, brazing and soldering. The Herco is a compact unit 15 in. by 12 in. by 18 in., weighing 100 lbs. Descriptive circular available upon request.

Diesel Drive For Portable Arc Welding Sets

★ Caterpillar Tractor Co., Peoria, Ill., has announced its D4400 diesel engine for direct connection to electric arc welding generators. In the illustration shown here the D4400 engine is coupled to a General Electric Type WD-33, 300 amp. machine. With a close regulating governor this unit gives 3½ per cent speed regulation at 1,500 rpm. It is stated that this combination has been used successfully on many jobs.

Diesel-driven 300-amp. G. E. arc welder.

The D4400 engine has a bore and stroke of 4¼ in. x 5½ in. and turns at 1,500 rpm. normal governed speed. Exceptionally smooth running and unusually flexible, the model is well suited for use as an electric power producer for welding.

The engine is of the four-stroke-cycle, valve-in-head, water-cooled design, and features solid injection of the fuel into precombustion chambers. The fuel injection system is similar to that of all "Caterpillar" diesels. Both the injection pumps and injection valves are set at the factory, and require no field adjustment. At rated load of 44 hp. the engine uses not more than 15.2 lbs. of low cost fuel per hour.

A 14-hp. two-cylinder gasoline starting engine is mounted at the rear of the diesel, directly over the flywheel housing. This engine cranks the diesel through a pinion and clutch arrangement which automatically disengages when the larger engine fires. For indoor installations, where atmospheric temperature is more or less constant, electrical starting is available.

Motor-Driven Electric Arc Saw For Production Cutting

★ An electric arc saw that will cut iron, steel, any alloy, ferrous or non-ferrous, tungsten carbide as readily as low carbon steel, and yet leave the surface of the cut clean and smooth has been announced by Miller Electric Mfg. Co., Appleton, Wis., under the trade name "Miller-Strobel" electric arc saw.

Miller-Strobel electric arc saw, Model C25, designed for cut-off work.

It is easy and safe to operate, due to the low voltage applied across the arc, and can be operated by anyone without special training. It cuts with equal efficiency, economy, and speed regardless of the hardness or analysis of the metal, and, it is claimed, without changing the temper or destroying the struc-

ture of the metal. It is said to be more economical and faster than any other type of metal cutting.

While the illustration here shows cross cutting, it can be furnished in special models for slotting, turning, arc threading, arc milling and arc turning, etc. Mechanically the sawing unit itself consists of a soft alloy steel blade provided with a multitude of small straight teeth on its circumference. This blade is V-belt driven at a high speed by an induction type electric motor.

Cuts are made by means of a controlled arc that "leaps" ahead of the saw and brings the metal along the kerf lines to a molten or plastic condition. The saw blade functions only to sweep the molten metal from between the kerf lines and as an electrode from which the heat generating arc "jumps" to the work. The blade itself does no cutting, as it is of soft metal. Its real function is to give an impulse to an oscillation of the current through a lengthening and shortening of the arc which stabilizes and directs the path of the arc to such an extent that side arcing is eliminated.

The arc, thus controlled, travels in a path a few thousands of an inch wider than the width of the blade. When cuts are completed the saw will be found to be cool. To generate the arc between the saw and the work, a specially built welding transformer is used to provide a current of suitable voltage and amperage to melt the metal to be cut. This current is controlled so that it will cut metal of various thicknesses. Stacked metal can be cut as easily as a solid piece of metal, it is stated. The "Miller-Strobel" electric arc saw is made in a range of models to handle different types of work.

New Marquette A-C. Welder

★ All three sizes of the new Marquette a-c. arc welders have been tested and are listed by the Underwriters Laboratories Re-examination Service and carry their marker. Model 100-B has a range from 20 to 150 amp., Model 200-B from 20 to 200 amp. and Model 300-B from 20 to 250 amp. All three embody improvements over last year's machines.

Marquette a-c. welder features a simplified panel for selection of any of 15 different heat stages.

The 1938 Model is known as the "Streamlined" Marquette a-c. arc welder. But it is streamlined for definite purposes—smartness, smoothness and speed. Smartness, not only to enhance the appearance of shop equipment, but also to add strength to the steel cabinet; smoothness to give a steadier and more even arc; and speed to eliminate confusion and simplify the method of arriving at the proper heat stage.

An important feature of this new welder is the oversize transformer which is able to operate continuously under a maximum load without overheating. The ability to operate coolly under such conditions greatly increases the life of the welder. Another advanced feature is the simplified panel arrangement which makes the selection of any of the 15 heat stages an easy matter. Each stage has a separate plug. There are no combinations to figure or dials to turn. The amperage is plainly marked beside each plug.

Model 100-B (20 to 150 amp.) is suitable for welding thin sheets to medium thickness steel, motor blocks, light castings, etc. Model 200-B (20 to 200 amp.) is for welding castings, thin sheets to heaviest steel and all motor blocks. Model 300-B is the heavy-duty welder delivering 20 to 250 amp which is enough to handle any welding job. All three models come fully equipped with helmet, electrode holder, all necessary cables, wall socket and a supply of assorted electrodes.

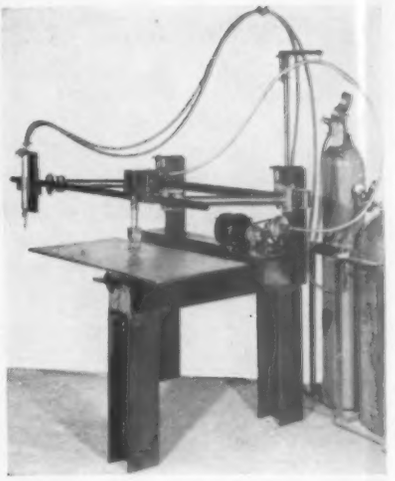
Hayes Torch Machine For Oxy-Acetylene Cutting

★ A manufacturer well known in the railway appliance field, Hayes Track Appliance Co., Richmond, Ind., has entered the welding equipment field with a simple flame-cutting machine to fill the needs of the fabricator who has only occasional use for a machine of this type. It is said that investment cost of the Hayes machine is 1/5 to 1/6 of that of more elaborate machines.

The Hayes machine has a pantograph arranged with a tracing wheel to follow the contour of any templet, or the lines of any drawing. The torch exactly duplicates the movement of the tracing wheel. The L-shaped frame gives the needed stiffness, but leaves space for placing material to be cut immediately at the left of the tracing table. The pantograph assembly is carried by upward extensions from the frame. All parts of the pantograph are made of heavy tubing, with sturdy but easy turning connections.

The power to move the tracing wheel is provided by a motor using ordinary lighting circuit current. This motor is secured to a base plate attached to the frame; the motor carries V-pulleys of various sizes and a V-belt extends to a jack shaft parallel to the armature shaft. The belt is shifted from one pair of pulleys to another to change the speed. From the jack shaft, a flexible shaft hung on a hinged arm, carries the power to a speed reducer at the top of the tracing wheel assembly.

The carrying arrangement for the torch allows the torch to be moved up and down and also slanted for cutting other than vertical such as for a bevel on a plate. The table under the tracing wheel is supported on a three-point bearing accurately adjustable to the tracing wheel.



Rugged construction of frame and power drive is a feature of the Hayes torch machine.

For circle cutting an arm hinged at the middle of the table is attached to the side of the tracing wheel assembly; the movement of the tracing wheel is then automatically guided by this arm.

The tracing wheel and torch are arranged to run at speeds of approximately 5, 10, 16 and 24 in. per minute. The 24-in. speed is right for cutting ½ in. and thinner material on either straight lines or easy curves. The 16-in. speed is for more intricate curves on thin material and easy cutting on thicker plates. Similarly the 10-in. and 5-in. speeds are for thicker material. With the 5-in. speed, material 6 in. thick may be cut by using the proper tip.

Designing for welding simplifies and speeds up installation of industrial piping systems.

News of the Industry

Laboratory Tests on Butt-Welded Rail Sections

The Association of American Railroads has made arrangements with the University of Illinois to conduct physical tests of butt-welded rail specimens. The University of Illinois is building up a rolling load machine to be used in conducting these tests.

Welded specimens prepared by the gas, thermit, and butt-flash welding processes have been furnished to the University and tests are now under way. Following is the general plan for the investigation of continuous welded rails:

1. Etch tests of the metal in specimens of welded rail joints made by various processes to see whether any "flakes" or "shatter cracks," or any other type of defect, have formed during the process of welding and subsequent cooling, and, if so, where these cracks are located in the joint.
2. Hardness surveys of the metal in the weld, in the adjacent rail and in the transition zone between weld metal and rail metal.
3. Survey of typical crystalline structure in weld, rail and transition zone by means of the metallographic microscope.
4. Mechanical tests of specimens cut from weld metal, rail metal, and transition zone. These tests would include tension tests, impact tests and fatigue tests.
5. Rolling-load fatigue tests of full-size specimens of welded rail to determine: (a) whether internal fissures can be developed in welded joints, (b) to determine the fatigue strength in flexure of welded joints, and (c) to determine likelihood of damage to the web of the rail near the weld.
6. Drop tests and bend tests of full-size rail joints.

It is planned to study first of all specimens made on short pieces of rail. These can be obtained more readily than can welded joints from track which has been laid down and should serve acceptably for the first series of survey tests. Later on it will probably be necessary to make tests on pieces of rail taken out of track.

Welding Wire Production Up 10 Per Cent In 1937

Producton of steel welding wire in 1937 amounted to 155,310,000 lbs., an increase of 10 per cent over the year before, according to information released by the American Iron and Steel Institute on April 14th.

Since 1932 the output of welding wire has increased more rapidly than the total production of steel. The 1937 welding wire output was approximately 545 per cent above the 1932 output of 24,150,000 lbs., which compares with an increase of only about 275 per cent in the production of steel ingots between 1932 and 1937.

The table below shows the actual and relative increase in welding wire production since 1932.

Year	Production of Welding Wire (Pounds)	Per Cent of 1932 Production: Welding Wire	Per Cent of 1932 Production: Steel Ingots
1932	24,150,000	100	100
1933	49,450,000	204	170
1934	72,100,000	299	193
1935	97,750,000	404	252
1936	140,300,000	573	353
1937	155,310,000	645	374

1938 A. S. T. M. Annual Meeting

During the week of June 27th to July 1st, inclusive, the forty-first annual meeting of the American Society for Testing Materials will be held at Chalfonte-Haddon Hall, Atlantic City, N. J. To provide sufficient time for the presentation and discussion of about 100 technical papers and reports on the program, some 18 formal sessions are being scheduled. These sessions are developed so that the papers and reports covering specific materials, fields, and topics will be grouped. The outstanding feature of the meeting is to be a Symposium on Impact Testing. Another interesting group of papers, to which a separate session will be devoted, involve radiographic testing.

The Symposium on Impact Testing is being developed jointly by the A. S. T. M. and the American Welding Society through its Welding Research Committee. Two sessions of the meeting will be devoted to the several papers covering specific topics. The symposium will be an effort to present an integrated series of papers covering the basic theories underlying impact tests, data on the factors affecting impact, and papers covering the practical application of impact tests to metals, organic plastics and welds. The symposium is prompted by the extraordinary interest in the subject.

The newly organized A. S. T. M. Committee on Radiographic Testing (designated Committee E-7) is developing a series of papers covering pertinent topics in this field. In addition to the subjects "quantitative gamma ray radiography; radiographic testing—its uses, abuses, and limitations; and secondary radiation in the radiography of aluminum, steel and lead," certain other topics will be considered.

Several interesting papers covering the properties of metals as affected by temperature and fatigue are scheduled. Some of these will cover problems of the relation of actual grain size to creep strength, temperature measurement and control in creep testing, effects of elevated temperatures on fatigue properties, and the problem of overstressing and understressing in fatigue. Other papers in the metals field will cover physical properties of four low-alloy high-strength steels, and surface cracks on large 18 per cent chromium, 8 per cent nickel alloy steel castings.

Golden Gate Exposition Plans a Welder's Day

A special day set aside for welders and welding is one of the features planned for the 1939 Golden Gate International Exposition on San Francisco Bay. Welders' and Welding Day has been tentatively set for Sunday, September 24 (1939), with many events planned for the occasion. Among the more spectacular features will be a demonstration of under-water cutting.

Several prize events are also planned including a contest among experienced operators cutting heavy sections of steel. A contest of welding a circumferential pipe joint by gas welding is also scheduled. The basis of award will include both speed of cutting and tensile strength of the finished weld, with a complete welding torch going to the winner.

Contests in electric welding will include very light gauge steel. The winner of this event is expected to receive a selection of suitable arc welding accessories. A special metal alloy calling for careful technique in electric welding will also be used.

Neon sign manufacturers are expected to cooperate in showing the welding of glass tubing and scientific laboratories will show the production of intricate glass apparatus with welded tubes. Western railroads will also be invited to demonstrate the more intricate railroad welding operations.

In addition to the technical demonstrations of welding in petroleum, refrigeration, shipbuilding and other industrial fields exhibits of various welding equipment, motion pictures and non-technical displays will be used for the benefit of the visitors to the Exposition. Arrangements are being made by E. L. Mathy of the San Francisco Section, A. W. S.

Some of the electric euipment in the welding shop of the New York Trade School, 304-326 East 67th St., New York City. This is a privately endowed vocational school (not for profit) offering courses in oxy-acetylene and electric arc welding.

Personals

HOWARD W. BEATTY has been appointed assistant manager of sales for rail steel and reinforcing bars, for Inland Steel Co., Chicago. Mr. Beatty has been associated with Inland Steel Co. for the past 16 years.

W. ROY WIDDOES has been appointed general manager of By-Products Steel Corp., Coatesville, Pa. Born in Coatesville in January, 1895, Mr. Widdoes was educated at Coatesville High School and joined Lukens Steel Co. in August, 1912, as a clerk in the time department. In 1929 Mr. Widdoes was appointed assistant purchasing agent of Lukens Steel Co. In May, 1937, Mr. Widdoes joined the By-Products Steel Corp. as assistant to the president and served in that capacity until his recent appointment as general manager.

L. G. BLISS has accepted a position as sales engineer for Foote Mineral Co., 1609 Summer St., Philadelphia, Pa. Previous to his present connection Mr. Bliss was employed by Foote Mineral Co. several years ago on research and sales work. He has published several papers on welding rod coatings. In January, 1936, he joined another chemical organization, but effective April 20th returned to Foote Mineral Co. to resume research and sales development work on electrode coatings.

RESEARCH FELLOWSHIP APPOINTMENTS ANNOUNCED

The first five Westinghouse Research Fellows have been selected for work in fundamental science at the Westinghouse Research Laboratories in East Pittsburgh. The successful candidates chosen from a group of 50 are:

Robert O. Haxby, University of Minnesota, age 26 years.

John A. Hipple, Princeton University, age 27 years.

Sidney Siegel, Columbia University, age 26 years.

W. E. Shoupp, University of Illinois, age 30 years.

W. E. Stephens, California Institute of Technology, age 26 years.

The five appointments are the first to be made under a plan announced last December, whereby Westinghouse plans to support the work of 10 young physicists on fundamental studies broadly related to the electrical industry. The fellows are appointed for one year and are eligible for one reappointment. The men will work under the general supervision of DR. E. U. CONDON, associate director of the laboratories.

HANDY & HARMAN ELECTS OFFICERS

HANDY & HARMAN, 82 Fulton St., New York, has elected new officers effective May 1st. CORTLANDT W. HANDY, president of the firm since 1927, becomes chairman. G. H. NIEMEYER, who has been connected with the firm for 38 years, assumes the office of president. R. H. LEACH, manager of the Bridgeport plant and director of research, will become vice-president in charge of production and research. H. W. BOYNTON and H. W. SPAULDING will continue as treasurer and secretary, respectively. J. C. TRAVIS, in the newly created office of assistant to the president, will have charge of sales.

CORTLANDT W. HANDY is the third generation of his family to head the firm of Handy & Harman. He entered the business in 1911 and became president in 1927. He will continue as the senior administrative officer.

G. H. NIEMEYER, who became president of Handy & Harman, was born in Chicago in 1883 and began as office boy at the age of 17. At the age of 19 he became the firm's first salesman. In 1915 he became manager of the New York plant, later sales manager and eventually vice-president in charge of sales and production.

In 1915 a large modern factory was built in Bridgeport, Conn. This is now the principal plant of the company. In 1924 a service plant was established in Providence, R. I. Two years ago a plant was built in Toronto, Canada, which is being operated for service to the Canadian trade by Handy & Harman of Canada, Ltd. A Chicago sales office has been established at 20 N. Wacker Drive for service to the trade in the Chicago area.

A. W. S. Activities

CLEVELAND SECTION, A. W. S.—ALBERT S. LOW, vice president and chief engineer of The Austin Company, Cleveland, addressed the Cleveland Section at its May 11th meeting. Mr. Low's subject was "Welded Construction in Some Recent Industrial Buildings." The Austin Co. is a pioneer in structural welding.

NORTHERN NEW YORK SECTION, A. W. S.—"Controlling Shrinkage and Distortion in Large Structures" was the subject of a talk by HARRY W. PIERCE, supervisor of welding of New York Shipbuilding Corp., Camden, N. J. Meeting was held on Thursday, April 21st, at Renssalaer Polytechnic Institute dining hall, in Troy, N. Y. W. F. HESS, chairman of the Section, presided.

PITTSBURGH SECTION, A. W. S., in conjunction with The Engineers' Society of Western Pennsylvania sponsored a Tri-State Welding Conference on April 29th. Meetings were held during afternoon and evening in the Cardinal Room, William Penn Hotel, Pittsburgh, Pa. The following speakers were on the afternoon program:

"Welding in the Production of Steel," ROBERT E. KINKEAD, consulting welding engineer, Cleveland, Ohio.

"Welded Construction in Some Recent Industrial Buildings" (illustrated with motion pictures), A. S. LOW, vice president and chief engineer, The Austin Company, Cleveland, Ohio.

Motion Pictures of "The Flash Welding of Rails" and "Welding Arcs," C. I. MACGUFFIE, arc welding specialist, General Electric Co., Philadelphia, Pa.

During the evening session the conference was addressed by the following men prominent in the welding industry:

P. G. LANG, JR., engineer of bridges, Baltimore & Ohio R. R., Baltimore, Md., president of The American Welding Society.

A. E. GIBSON, president, Wellman Engineering Co., Cleveland, Ohio, past-president of The American Welding Society.

"Welding in the Construction of Cranes and Power Excavators," H. C. HETTELSATER, executive engineer, Harnischfeger Corp., Milwaukee, Wis.

Trade News

JONES & LAUGHLIN STEEL CORP., Pittsburgh, Pa., appointed three assistant general sales managers, effective April 1st. R. T. ROWLES and W. H. WIEWEL, new assistant general sales managers, will have general supervision over product sales departments, and H. J. WATT, new assistant general sales manager, will have supervision over the Eastern district sales offices.

RICHARD E. ELA CO., 921 E. Washington Ave., Madison, Wis., has established a welding supply business to handle the following lines of equipment: Rego oxy-acetylene equipment and welding rods, Stoody Co. hard-facing electrodes, General Electric welders and electrodes, Arcos electrodes, Welding Alloys Co. rods and a general line of industrial equipment.

C. E. PHILLIPS & CO., 2750 Poplar St., Detroit, Mich., at a recent directors' meeting elected the following officers: C. E. PHILLIPS, president; J. C. MENZIES, vice-president; J. A. SCANE, treasurer; LEE E. JOSLYN, secretary.

C. AND W. PRODUCTS CO., 5850 Forsythe St., Detroit, Mich., has taken over the business formerly conducted by The E. and M. Sales Co., manufacturers of welding machines. FRANK E. WRAY is sole owner of the C. and W. Products Co.

NEW PROCESS PLOW WELDING CO., Perry, Iowa, has appointed United States Welding Co., 1325 Market St., Denver, Colo., as its jobber in Colorado, Wyoming and Western Nebraska.

J. F. LINCOLN, president of THE LINCOLN ELECTRIC CO., Cleveland, Ohio, announces establishment of a manufacturing subsidiary to be called Lincoln Electric Co. (Australia) Pty., Ltd., at Sydney, Australia. A suitable factory has already been purchased and arc welding equipment manufacture will begin in a year's time.

ROBINSON WELDING SUPPLY CO., 1921 East Ferry Ave., Detroit, Mich., has recently been appointed distributor for Air Reduction Sales Co. in the vicinity of Detroit, for oxygen and acetylene.

HELPING GOOD MECHANICS DO BETTER WORK

CUT FINISHING COSTS WITH THESE VERSATILE GRINDERS

ONE of the most profitable Tools in the foundry or welding shop is a Black & Decker Portable Electric Grinder. It will quickly grind welding grooves and welds, snag castings, and handle countless other jobs that formerly required slow, laborious hand filing, sanding, chipping. Black & Decker Grinders are light, powerful, perfectly balanced, easy to handle in any position. There's a Grinder to suit your requirements in the complete Black & Decker Line. See your Jobber for a demonstration—or write for details. The Black & Decker Mfg. Co., 753 Pennsylvania Avenue, Towson, Maryland.

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PORTABLE ELECTRIC TOOLS

BOLIVAR WELDING WIRE CO., Bolivar, Pa., has appointed Oliver Bros., Inc., New York City, as territorial sales representative for its line of Supreme welding electrodes.

THE INDEPENDENT PNEUMATIC TOOL CO. of Chicago, Ill., announces the opening of a new sales-service branch at 6200 E. Slauson Ave., Los Angeles, Calif. The new office will be in charge of B. J. HERRON.

THE WHITEHEAD METAL PRODUCTS CO. opened its new warehouse and assembly plant at 287-303 West Tenth St., New York City, on April 18th. Now a subsidiary of the INTERNATIONAL NICKEL CO., the Whitehead organization has been located at 304 Hudson St. for the past 11 years, where it has maintained main offices as well as facilities for warehousing and distributing metals including nickel, monel, copper, brass and aluminum in commercial shapes.

GENERAL ELECTRIC CO. employees during 1937 received nearly $85,000 for new ideas submitted through the company's suggestion system. During the year almost 37,000 suggestions were made by workers, and more than 12,000 were adopted. During the past 11 years nearly $600,000 has been paid out to employees for new ideas adopted for use.

INDUSTRIAL WELDING ENGINEERS, 2137 S. Wabash Ave., Chicago, Ill., has established a specialized course of training under supervision of J. J. MCNAMEE for teaching welders who wish to prepare themselves for qualification under Paragraphs U-68, U-69, U-70 of the A.S.M.E. Code. J. J. McNamee was formerly welding foreman assigned to a U. S. Navy floating dry dock. Preparation for a navy test is also a part of the course.

Okocord EXTRA FLEXIBLE WELDING CABLE

YOU WILL GET REAL SERVICE from welding cable that has extreme flexibility, resistance to severe abuse, and insulation that can be relied on for the life of the cable.

Okocord Welding Cable has all three characteristics and, in addition, resists moisture and the destructive action of chemicals. It will give you long, trouble-free service, and do it economically.

THE OKONITE COMPANY

EXECUTIVE OFFICE OKONITE PASSAIC, NEW JERSEY

Foreign News

THE BRITISH OXYGEN COMPANY'S plan to manufacture calcium carbide has been carried a stage further by the registration of a new private concern—Carbide Industries. British Oxygen plans to build a huge factory in South Wales for the manufacture of calcium carbide and is seeking powers to manufacture the same product in Scotland. At present all calcium carbide supplies for the United Kingdom are imported.

GERMAN COPPER AND BRASS WELDING PRACTICE

Last year the German Copper Institute in Berlin published a valuable booklet on the welding of copper and brass. This very practical treatise has now been published in English by the Copper Development Association, London. Under the title of "German Copper and Brass Welding Practice," an outline is given of the treatment of German copper, which, with its oxygen content of 0.02 per cent to 0.10 per cent, is stated to be camparable to British tough pitch copper. Starting with the basic principles of welding, a table summarizing types of joints, the prepartion of seams for welding, the maintenance of gap, characteristics of the welding flame, and types of welding rod and fluxes are dealt with.

Precautions in the use of backing plates and how to avoid risk of strain fissures are stated in a simple manner, while sections on the treatment of copper welds, on examples of welded work including a hopper head, a manifold, a colorifier and an autoclave, all furnish proof that the book is intended to serve the practical man.

An equally explicit section on electric welding is included. Brass welding occupies only a small section of the booklet, since welding of brass is facilitated by its greater fluidity and smaller stresses developed.

BRITISH STANDARDIZE ELECTRODES FOR SHIP WELDING

A new standard specification covering electrodes for metal arc welding in ship construction has just been published by the British Standards Institution, London. The requirements of this new standard are intended primarily to indicate the tests with which a particular class of electrode should comply, before it will be approved by the ship registration authorities as being suitable for use in metallic arc welding.

It also provides for periodical check tests to be made on electrodes that have been approved. The specification calls for four tensile and bend tests on butt-welded joints and tensile tests on two forms of fillet weld test pieces. It also provides for tensile, bend and impact tests on all-welded metal test

pieces. The requirements embodied in the specification are those which were originally prepared by the Board of Trade in collaboration with the ship classification societies.

In response to representations made by the industry, these requirements have been adopted in this standard specification without modification. As a consequence, forms of the test pieces to be used, in one or two of the tests, are not similar to the forms previously included in other British standard specifications.

Recent Patents

Resistance Welding Method

2,109,461. Jesse Brown, Syracuse, N. Y. Issued Mar. 1, 1938. Filed July 17, 1936. A method of electric resistance welding consisting of applying normal mechanical forging pressure to the work through one set of electrodes and applying at least a portion of the welding current to the work through other electrodes exerting a lower mechanical pressure.

Welding Device

2,110,271. David T. May, Port Washington, N. Y., assignor to Bell Telephone Laboratories, New York, N. Y. Issued Mar. 8, 1938. Filed Aug. 8, 1935. The combination in a tool for welding flexible strip metal to a stationary object of plier members pivoted together, a reel for holding a supply of said flexible strip metal and mounted for rotation about the pivotal axis of said plier members, means for advancing said strip toward the welding point, welding electrodes attached to said plier members, and handles acting on said plier members to bring said electrodes into engagement with said stationary object and said flexible strip of metal and to bring the flexible strip into engagement with the stationary object to effect the welding operation.

Copper-Base Alloy and Welding Rod

2,112,373. Arthur R. Lytle, Niagara Falls, N. Y., assignor to Oxweld Acetylene Co., of New York. Issued Mar. 29, 1938. Filed Mar. 28, 1936. A copper-base alloy for use in articles which must resist surface wear at elevated temperatures below 500 deg. F., said alloy having substantially the following composition: 48% to 62% copper, 2% to 5% tin, 0.25% to 1.5% iron, and silicon in an amount not over 1.5%, remainder zinc.

Welding Apparatus

2,112,552. Robert R. Applegate, Shaker Heights, Ohio. Issued Mar. 29, 1938. Filed June 2, 1937. In combination, a coated electrode having a bared portion extending longitudinally thereof, and means for filling the bared portion at the time of use of the electrode.

Sheathed Welding Electrode

2,112,578. Hans Rohrig, Lautawerk/Lausitz, Germany. Issued Mar. 29, 1938. Filed Dec. 4, 1936. An electrode comprising a sheathed metal rod adapted for the arc welding of light metals and alloys of light metals, said sheath comprising an inner layer of a mixture of alkali-chlorides and an outer layer of a mixture of aluminum fluorides and alkali-chlorides.

Welding Rod

2,113,222. Willy Rochocz, Baltimore, Md., assignor to Jack Greenbaum, Baltimore, Md. Issued April 5, 1938. Filed Dec. 18, 1936. In an oxyacetylene welding rod, a metallic member carrying a flux consisting of substantially the following proportions by weight: 45% sodium carbonate, 45% borax, 3% carbon, 2% ferro-silicon, 2% gelatine, and 3% silicate.

Trade Literature

American Rolling Mill Co., Middletown, Ohio, has published an 8-page booklet which gives selling points on stainless steel products, a brief account of the history of this relatively new metal, and other information of value to the retailer of stainless household equipment. The advantage of capitalizing the Armco trademark on these products is presented in another section, along with an account of the exhaustive advertising program which caused "Armco to be thought of as—A name known to millions."

If YOU'RE DOING WELDING

You Can't Afford to be Without...

The New MARQUETTE A.C. ARC WELDER

Because: it soon pays for itself through its super-efficiency and fast low-cost operation.

Because: it is moderately priced at from $155 to $225, and

Because: it is sold by Jobbers on an easy payment plan.

You can put yourself in the fast-growing, profitable welding business without investing a large sum in equipment when you buy a MARQUETTE A. C. ARC WELDER.

- Three models at three prices . . . a size and price to fit your needs.
- Oversize transformer gives steady even arc at all 15 heat stages.
- A tap for every heat, a heat for every job . . . no dials, no combinations, no confusion.
- Ample ventilation through bottom screen and louvered top.
- Every model fully equipped . . . nothing extra to buy.

Every Marquette A. C. Arc Welder is listed by Underwriters' Laboratories, Inc., and carries their Reexamination Service Marker.

MARQUETTE MFG. CO., INC.
MINNEAPOLIS, MINNESOTA

The Improved "Round File" Gas Lighter

Locking "Slip-on" Renewal

—an exclusive feature

The patented cartridge holding the spark metal locks exactly in correct position, permitting instant replacement.

Get acquainted with the many other superior, exclusive features of Improved "Round File." ***Circulars and prices on request.***

SAFETY GAS LIGHTER CO. (Est. 1901) **LYNN, MASS.**

AMERICAN TRANSFORMER CO., 178 Emmet Street, Newark, N. J., has issued a four-page bulletin describing the "Trans-Arc," an a-c. arc welder for operation on 230- or 460-volt primary voltage, 50- or 60-cycle circuit. This machine features a low open-circuit voltage and through a condenser arrangement operates with a leading power factor of from 60 to 90 per cent, it is claimed. It is pointed out that with this equipment it is possible to help correct an over-all lagging power factor in any plant circuit. It is further claimed that this is the only welding equipment that offers this power factor correction. Copy of the bulletin will be mailed to any reader who may request it by writing the manufacturer.

NEW PIPE WELDING BULLETIN—Arc welding of piping for operation at pressures up to 1,500 lbs. per sq. in. and temperatures up to 1,000 deg. F. is covered in a new 12-page bulletin issued by the Metal & Thermit Corp., 120 Broadway, New York City. In addition to the selection of pipe materials and welding electrodes, this bulletin discusses weld design, welding procedure, preheating, stress relieving, testing of welds and the qualification of welding process and welding operators.

"BONNEY WELD-O-LETS AND THRED-O-LETS" is the title of a 16-page booklet just issued by Bonney Forge and Tool Works, Allentown, Pa. The bulletin illustrates how these welding fittings are employed in pipe fabrication and emphasizes that welded branch connections in piping are made stronger and better and at lower cost by their use. With the aid of numerous illustrations, methods are detailed for installation of Weld-O-lets and Thred-O-lets. These units can be installed by arc or oxy-acetylene welding. Dimensional data are included, showing stock sizes of both types.

PAGE HI-TENSILE G ELECTRODES—A 12-page booklet has just been issued covering a new electrode—Page Hi-Tensile G. It is especially recommended for flat and positioned fillet and general flat welding, and has recently been added to the line of electrodes manufactured by Page Steel and Wire Division of American Chain & Cable Co., Inc., Monessen, Pa. This is a high-speed smooth-flowing electrode of the shielded arc type, suitable for use with either motor generator or transformer type machines. A copy of this booklet can be secured by writing direct to the manufacturer.

UNA WELDING, INC., Cleveland, Ohio, has just issued Bulletin No. 151 describing the Una automatic arc welding head, including the Una taper attachment. This taper attachment provides for an impregnated tape which can be fed automatically with the welding rod to provide an automatic shielded arc for production welding. The bulletin lists the information required in order that the manufacturer can submit a cost estimate to a prospective user.

THE HAYES TORCH MACHINE—Hayes Track Appliance Co., Richmond, Indiana, has just published a four-page bulletin describing its new pantograph torch-cutting machine. Structural details, cutting speeds and operating range of the machine are covered. The Hayes machine utilizes a tracing wheel to follow a templet or pencil drawing.

TAYLOR-WINFIELD CORP., Warren, Ohio, has just issued Bulletin No. 5-A, a four-page folder describing its manually-operated Type W spot welders. A feature of the machine is the one-piece welded steel frame which replaced the two-piece cast-iron frame formerly used.

CATALOG ON THOR PORTABLE ELECTRIC TOOLS—The complete 1938 line of THOR portable electric tools is described in a new 48-page catalog just issued by The Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill. Containing four major sections, the book gives complete descriptions, specifications and prices on the entire THOR line of universal type electric drills, drill stands, screw drivers, nut setters, tappers, saws, hammers, grinders, polishers, sanders, heat guns and electric tool accessories. The catalog is available to industrial executives and engineers upon request.

Ryerson a dependable source for Welding Rod

● Ryerson Engineers have developed a series of rods that are outstanding for Quality production. More than twenty types, including both electric and gas rods, are carried in stock. Whether you need a shielded arc type for production work or a stainless steel rod you can be sure of immediate shipment... *Write for Bulletin which gives complete data.*

ELECTRODES

Ryerson
Shielded Arc Type No. 215
Shielded Arc Type No. 216
Shielded Arc Type No. 217
Green Processed No. 18
Copper Coated No. 206
Copper Coated No. 210
Cast Iron

Ryerson
Green Processed No. 6
Bare Mild Steel
Brown Processed
White Flux Coated
High Carbon White Flux
Coated
Blue Flux Coated

GAS RODS

3½% Nickel Steel
High Carbon Bare No. 2110

Ryerson
3½% Nickel Steel Flux Coated
High Manganese Steel
Hard Surfacing
Allegheny Stainless Flux Coated
Allegheny Stainless No. 44

Tobin Bronze
Allegheny Stainless Bare Hard Filler

JOSEPH T. RYERSON & SON, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City